



FINAL REPORT

Proposed changes to the Dams Safety Regulation 2019

Cost-benefit analysis

*Prepared for
Dams Safety NSW
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Executive summary

Background

Following an independent review of the previous *Dams Safety Act 1979* and the Dams Safety Committee in 2013, the NSW Government has developed a new regulatory framework for dams safety in NSW. The new regulatory framework is set out in the *Dams Safety Act 2015* and the supporting *Dams Safety Regulation 2019* which was approved on 16 October 2019. The new regulatory framework comprising the Act, regulation and standards commenced on 1 November 2019.

There is a phasing-in period of up to two years for requirements relating to operations and maintenance plans and emergency plans.

Proposed changes to the regulation

Although the new regulatory framework is not yet fully operable, the new regulator Dams Safety NSW is proposing some amendments to the Dams Safety Regulations 2019. The proposed amendments include the introduction of a Dams Safety Levy as well as a number of proposed changes to the existing regulation to address some identified deficiencies. The proposed changes include the following.

- Dams Safety NSW is proposing some administrative changes to ensure efficient operation of the regulatory framework. These changes are as follows.
 - Declared dam owner must provide Dams Safety NSW with the name and details of a contact person
 - Declared dams owners must nominate an accountable individual for the dam safety management system
- Dams Safety NSW is also proposing some changes to ensure the integrity of the regulatory framework and improve safety outcomes. The proposed changes are as follows.
 - Dams Safety NSW is proposing that:
 - ... the calculation for the assessment of the risk rating of a dam be carried out by a competent person
 - ... for high or extreme consequence category dams, the calculation for the assessment of the risk rating of a dam be reviewed by an independent competent person.
 - Dams Safety NSW is proposing that for high and extreme consequence category dams:
 - ... the safety review must involve a panel of not less than three competent persons (rather than an individual competent person, as is currently required)

- ... the review of the safety review must also be conducted by a panel.
- ... The panel(s) must collectively have persons with experience, training or professional qualifications in relation to each of the relevant specialties in relation to the dam.
- Dams Safety NSW is proposing that the check of the design of a high or extreme consequence category dam must involve a panel of not less than three competent persons (rather than an individual competent person as is currently required).
 - ... The panel must collectively have persons with experience, training or professional qualifications in relation to each of the relevant specialties.
 - ... Independent technical review by a panel or body with appropriate expertise is consistent with the recommendations of the Paradise Dam Commission of Inquiry.

Cost-benefit analysis

Under its legislation, Dams Safety NSW is required to prepare a cost-benefit analysis (CBA) of proposed changes to the regulations. This is also consistent with the NSW Government's regulatory policy requirements.

Dams Safety NSW has therefore commissioned the Centre for International Economics (CIE) to prepare a CBA of the proposed amendments to the regulations.

Impact of administrative changes

The impacts of the proposed administrative changes include the following.

- The requirement to nominate a contact person and an accountable individual and notify Dams Safety NSW would impose an administrative cost on dam owners. The cost associated with notifying Dams Safety NSW when the contact person or accountable individual changes or their contact details change would presumably take an administrative a maximum of around half an hour each time that was required. These costs can be considered trivial.
- On the benefits side, these measures support the efficient administration of the regulatory framework. However, these benefits are difficult to measure.

Any benefits from more efficient administration of the regulatory regime is likely to outweigh any costs.

Impact of safety-related changes

The proposed safety-related changes to the regulations are essentially measures to ensure that key regulatory activities are undertaken (and where relevant checked/reviewed) by people with appropriate competencies. These changes will help to ensure the integrity of the new regulatory framework. To some extent, these changes reflect current practice among well-informed dam owners.

We estimate the costs of the proposed regulatory changes at around \$18.75 million in present value terms over 10 years, using the NSW Government's preferred discount rate of 7 per cent (table 1).

1 Estimated cost of proposed regulatory changes

	Estimated cost to dam owners	Impact on practitioners	Net impact
	\$ million	\$ million	\$ million
Risk rating ^a	- 1.42	1.42	0.00
Risk rating review	- 4.38	0.00	- 4.38
Safety review	- 5.26	0.00	- 5.26
Review of safety review	- 6.33	0.00	- 6.33
Design check	- 2.78	0.00	- 2.78
Total	- 20.18	1.42	- 18.75

^a The additional requirements relating to risk ratings relate to who may undertake a risk rating. As such, the impact on dam owners relates to the price of services, rather than an additional requirements. As such, we assume that the cost to dam owners is offset by a benefit to practitioners.

Note: Estimates are presented in present value terms over the 10 year period (2021-2030), using a discount rate of 7 per cent.

Source: CIE estimates.

The benefits from strengthening the regulatory requirements could include the following.

- Avoided remediation works to ensure a dam complies with relevant dam safety standards — independent review (particularly of dam designs) can avoid future remediation works.
- Avoided 'gold-plating' of dams — discussions with practitioners suggested that there is the potential for safety reviews and upgrade designs to lead to over-investment in safety (referred to as gold-plating). In particular, there have been cases where consultants (either deliberately or sub-consciously) do not recommend the most cost-effective solution (in some cases because this could lead to further work for the consultant). Discussions with practitioners suggested that reviews can result in more cost-effective solutions.
- Avoided costs associated with dam failures — in extreme cases, strengthening of the regulatory requirements could avoid a dam failure. Dam failures can impose significant (in some cases catastrophic) costs on the community including:
 - loss of human life
 - damage to private property
 - damage to infrastructure
 - loss of the services provided by the dam
 - damage to the environment.

It is not possible to quantify these benefits with any precision. That said, to the extent that the enhanced regulatory requirements avoid any of the outcomes discussed above, the benefits are likely to be large.

On that basis, it is plausible that the benefits would outweigh the costs; however, it is not possible to be certain.

1 Background and introduction

Dams safety regulatory framework

Following an independent review of the previous *Dams Safety Act 1979* and the Dams Safety Committee in 2013, the NSW Government has developed a new regulatory framework for dams safety in NSW. The new regulatory framework is set out in the *Dams Safety Act 2015* and the supporting *Dams Safety Regulation 2019* which was approved on 16 October 2019. The new regulatory framework comprising the Act, regulation and standards commenced on 1 November 2019.

There is a phasing-in period of up to two years for requirements relating to operations and maintenance plans and emergency plans.

Proposed changes to the regulations

Although the new regulatory framework is not yet fully operable, the new regulator Dams Safety NSW is proposing some amendments to the Dams Safety Regulations 2019. The proposed amendments include the introduction of a Dams Safety Levy as well as a number of proposed changes to the existing regulation.

This report

Under its legislation, Dams Safety NSW is required to prepare a cost-benefit analysis (CBA) of proposed changes to the regulations. This is also consistent with the NSW Government's regulatory policy requirements.

Dams Safety NSW has therefore commissioned the Centre for International Economics (CIE) to prepare a CBA of the proposed amendments to the regulations.

2 *The problem*

Although the new dams safety regulatory framework has not yet been fully phased in, Dams Safety NSW has identified a number of potential issues with the regulatory framework.

Efficient operation of the regulatory framework

The following issues have arisen in relation to the efficient administration of the new regulatory regime.

- Dams Safety NSW has had difficulty identifying appropriate contact details for the owners of some declared dams, resulting in delays and other challenges in administering the Act.
- There is currently no requirement for the declared dam owner to nominate an accountable person for the dam safety management system.

Safety-related issues

Key elements of the new dams safety regulatory framework include:

- risk ratings
- safety reviews
- design checks.

Risk ratings

Under the current regulations, an assessment of societal and individual risk rating must be carried out:

- at least every 5 years
- if a major change is proposed to be made to the dam
- if required to do so by Dams Safety NSW.

The societal risk rating or highest individual risk rating of the dam feeds into the safety threshold that a dam must meet. Accurate risk ratings are therefore a key element of the regulatory framework. However, currently:

- there is no requirement for the societal risk rating to be carried out by a competent person, and
- no requirement for the societal risk rating calculation to be checked by an independent competent person.

Where risk ratings are completed or checked by a person without the relevant competencies, this could compromise the integrity of the regulatory framework.

Safety reviews

Currently, owners of declared dams must ensure that a safety review to assess the overall safety of the dam is undertaken:

- at least every 15 years, or
- as soon as practicable after any of the following occurs:
 - a deficiency or weakness is identified in the dam
 - there is a change (other than a minor change) to the accepted technology or methods used in one of the relevant specialties or in the design criteria for dams
 - the consequence category of the dam is changed
 - Dams Safety NSW gives written notice to the owner of the dam requiring a safety review of the dam to be carried out.

Safety reviews are a critical safety measure under the new regulatory framework.

- Currently safety reviews must be undertaken by a competent person; however, there is no requirement for the competent person carrying out the safety review to have all the required competencies for the safety review.
- Safety reviews of extreme and high consequence category dams must currently be independently reviewed by a competent person; however, there is no requirement for the independent competent person to have all of the required competencies for the independent review.

It is unlikely that a single person would have all of the relevant competencies to complete a satisfactory safety review of an extreme or high consequence category dam.

Safety reviews of high and extreme consequence category dams that are undertaken (and checked) by a person that does not have all of the required competencies could potentially overlook safety issues and therefore compromise safety objectives. This could potentially:

- lead to delays in remediation works (and therefore increase the cost)
- In some circumstances, this could potentially lead to a dam failure.

Design checks

For extreme and high consequence category dams, a competent person must check work involving dam design. However, there is no current requirement for the competent person carrying out a check of a design to have all of the required competencies.

As above, it is unlikely that a single person would have all of the relevant competencies to complete a satisfactory design check of an extreme or high consequence category dam. Safety reviews of high and extreme consequence category dams that are undertaken (and checked) by a person that does not have all of the required competencies could

potentially overlook safety issues and therefore compromise safety objectives. This could potentially:

- lead to delays in remediation works (and therefore increase the cost)
- lead to a dam failure in extreme cases.

A lack of an independent technical review panel during design was identified as one of the issues that may have contributed to the stability issues for Paradise dam in Queensland (see box 2.1).

2.1 Case study – Paradise dam¹

Paradise dam is located on the Burnet River 80 Km south west of Bundaberg in Queensland. It was designed and built between 2003 and 2005. It was certified as safe to fill to full supply level and that works as constructed had been undertaken in a manner which met design requirements in late 2005.

The dam first filled in March 2010. It subsequently experienced flooding in:

- December 2010
- January 2011
- January 2013.

The flooding caused unanticipated damage to the primary spillway apron, even though the 2011 and 2013 flooding events were smaller than the maximum flows that the dam had been designed to withstand. The 2013 flooding event also caused scouring of the riverbed immediately downstream.

Subsequent investigations identified structural and stability issues.

- Although the dam is stable in circumstances no more severe than those experienced in the 2011 and 2013 flood events, it is uncertain whether it is stable for larger floods.
- The dam does not meet the Guidelines on Design Criteria for Concrete Gravity Dams published in 2013 by the Australian National Committee on Large Dams (ANCOLD).

To enhance dam stability and community safety (and in preparation for Essential Works), dam capacity was reduced to 42 per cent in September 2019.² A business case on options for Paradise dam is currently being prepared. The cost of remedial works to return the dam to full capacity have been estimated at around \$700 million.

Furthermore, practitioners suggested that a lack of a rigorous peer review process can lead to excessive conservatism and excessive costs in relation to both the design of new dams and upgrades to existing dams.

¹ Paradise Dam Commission of Inquiry, Report, April 2020.

² Sunwater website, <https://www.sunwater.com.au/projects/paradise-dam-essential-works/>, accessed 13 December 2020.

Quantifying the size of the problem

It is difficult to quantify the extent to which the issues with the current regulatory framework identified above compromise safety objectives and impose costs on dam owners and the community.

In general, there have been few dam failures in NSW and none that have involved the loss of human life. However, for low probability and high-cost events (such as dam failures), the past is not necessarily a good predictor of the future.

Nevertheless, the cost of practitioner errors (that are not identified through a peer review process) in relation to dam safety are potentially large.

- The costs associated with the failure of a major dam are potentially catastrophic, possibly involving:
 - loss of a large number of human lives
 - injuries
 - widespread damage to private property and infrastructure
 - the loss of the services provided by the dam.
- The cost of remedial works relating to inadequate designs can be in the hundreds of millions of dollars (see Paradise dam example — box 2.1).
- Furthermore, excessive conservatism that is not sufficiently challenged through an independent and rigorous peer review process could increase costs by tens of millions of dollars.

3 *Proposed changes to the regulations*

Proposed administrative changes

To address the issues outlined in chapter 2, Dams Safety NSW is proposing making the following changes to the regulations.

Nomination of contact person

Dams Safety NSW is proposing that a declared dam owner must provide Dams Safety NSW with the name and contact details of a contact person. It is proposed that the contact person:

- must be part of the dam owner's organisation (whether a director, manager or other employee), and
- may be nominated in respect of one or more dams, provided that a person is nominated in respect of each dam.

If there is a change in the contact person, or the person's contact details change, the dam owner must notify Dams Safety NSW of the change within 14 days.

Nomination of an accountable individual

Dams Safety NSW is proposing that the dam safety management system specify an individual who is responsible for ensuring compliance with the dam safety management system.

It is proposed that the declared dam owner would provide Dams Safety NSW with the name and contact details of the individual, as part of the dam safety management system.

The individual must:

- be part of the dam owner's organisation (whether a director, manager or other employee); and
- authorised by the owner of the dam to do all things necessary to ensure compliance with the dam safety management system; and
- may be nominated for one or more dams.

If there is a change to the nominated individual or the individual's contact details change, the dam owner is to notify Dams Safety NSW of the change within 14 days.

Proposed safety-related changes

Proposed changes to the regulations to tighten existing regulatory requirements are outlined below.

Risk ratings

Dams Safety NSW is proposing that:

- the calculation for the assessment of the risk rating of a dam be carried out by a competent person
- for high or extreme consequence category dams, the calculation for the assessment of the risk rating of a dam be reviewed by an independent competent person.

Safety reviews

Dams Safety NSW is proposing that for high and extreme consequence category dams:

- the safety review must involve a panel of not less than three competent persons (rather than an individual competent person, as is currently required)
- the review of the safety review must also be conducted by a panel.

The panel(s) must collectively have persons with experience, training or professional qualifications in relation to each of the relevant specialties in relation to the dam.

Design checks

Dams Safety NSW is proposing that the check of the design of a high or extreme consequence category dam must involve a panel of not less than three competent persons (rather than an individual competent person as is currently required).

The panel must collectively have persons with experience, training or professional qualifications in relation to each of the relevant specialties.

Independent technical review by a panel or body with appropriate expertise is consistent with the recommendations of the Paradise Dam Commission of Inquiry (see box 3.1).

3.1 Paradise Dam Commission of Inquiry – relevant recommendations³

- The Commission encourages consideration by the Regulatory of mandating the independent technical review of referable dam projects (**Recommendation 2**).
- The panel or body established to conduct the independent technical review should have the authority to co-opt others with appropriate expertise to conduct peer review of matters beyond the collective expertise of the panel members or where obtaining additional views is considered advisable (**Recommendation 3**).
- Matters for review should include but may not be limited to regulatory, safety and operational requirements, the principal components of the dam and its critical design parameters (**Recommendation 4**).
- The Regulator should consider how best to ensure the independence of the persons chosen to conduct peer reviews and whether guidelines to assist and direct those in peer reviewing dam projects would be useful (**Recommendation 5**).

³ Paradise Dam Commission of Inquiry, Report, April 2020, p. 6.

4 Impacts of proposed changes

Administrative changes

The impacts of the proposed administrative changes include the following.

- The requirement to nominate a contact person and an accountable individual and notify Dams Safety NSW would impose an administrative cost on dam owners. The cost associated with notifying Dams Safety NSW when the contact person or accountable individual changes or their contact details change would presumably take an administrative a maximum of around half an hour each time that was required. These costs can be considered trivial.
- On the benefits side, these measures support the efficient administration of the regulatory framework. However, these benefits are difficult to measure.

Safety-related changes

The costs and benefits of the proposed safety-related changes are discussed below.

Estimated costs

The cost of the proposed safety-related changes depend on a range of factors, including:

- the extent to which the new regulatory requirements reflect existing practice for some or all dam owners;
- the additional cost of complying with the proposed requirement relative to current practice (to the extent that the proposed requirements do not reflect current practice);
- the number of dams affected;
- the frequency with which the various regulatory processes occur.

We estimate the costs of the proposed regulatory changes at around \$18.75 million in present value terms over 10 years, using the NSW Government's preferred discount rate of 7 per cent (table 4.1). The assumptions underpinning this estimate are set out below.

4.1 Estimated cost of proposed regulatory changes

	Estimated cost to dam owners	Impact on practitioners	Net impact
	\$ million	\$ million	\$ million
Risk rating ^a	- 1.42	1.42	0.00
Risk rating review	- 4.38	0.00	- 4.38
Safety review	- 5.26	0.00	- 5.26

	Estimated cost to dam owners	Impact on practitioners	Net impact
	\$ million	\$ million	\$ million
Review of safety review	- 6.33	0.00	- 6.33
Design check	- 2.78	0.00	- 2.78
Total	- 20.18	1.42	- 18.75

^a The additional requirements relating to risk ratings relate to who may undertake a risk rating. As such, the impact on dam owners relates to the price of services, rather than an additional requirements. As such, we assume that the cost to dam owners is offset by a benefit to practitioners.

Note: Estimates are presented in present value terms over the 10 year period (2021-2030), using a discount rate of 7 per cent.

Source: CIE estimates.

Estimated number of dams

There are currently (as at October 2020) 400 declared dams in NSW. The proposed changes to the regulation makes a distinction between:

- Extreme and High (including High A, High B and High C) consequence category dams
- other dams (including Significant and Low consequence category dams).

Discussions with practitioners also suggested the following.

- Current practices are likely to vary between:
 - Well-informed owners (i.e. owners who are familiar with and follow best practice) — for the purposes of the CBA, we assume that this group of owners includes:
 - ... WaterNSW
 - ... Snowy Hydro
 - ... Hunter Water
 - ... Sydney Water
 - Other owners — practitioners suggested it was less likely that other owners (including councils and mining companies) would fully understand their responsibilities and follow best practice.
- The cost of complying with various regulatory requirements is likely to vary based on a range of factors, including the size and complexity of the dam. For the purposes of the CBA, we make a distinction between:
 - Small dams — we assume this includes dams less than 10 metres high (this mainly includes detention basins)
 - Medium dams — we assume this includes dams greater than 10 metre, but less than 50 metres, and
 - Large dams — we assume this includes dams greater than 50 metres.

A disaggregation of dams that are currently declared across all of these dimensions (i.e. consequence category, ownership and size) is shown in table 4.2. Dam heights were not available for a small number of dams. Where the height of the dam is unknown, for the purposes of the CBA we assumed that: detention basins are in the small category (i.e. less than 10 metres); and other types of dams are in the medium category (i.e. between 10 and 50 metres).

4.2 Disaggregation of dams

	Informed owners		Other owners		Total
	Extreme and high consequence	Significant and low consequence	Extreme and high consequence	Significant and low consequence	
	No.	No.	No.	No.	
Small	5	9	62	82	158
Medium	24	12	84	81	201
Large	24	1	10	6	41
Total	53	22	156	169	400

Note: Dam heights were not available for a small number of dams. Where the height of the dam is unknown, for the purposes of the CBA we assumed that: detention basins are in the small category (i.e. less than 10 metres); and other types of dams are in the medium category (i.e. between 10 and 50 metres).

Source: CIE based on data from Dams Safety NSW.

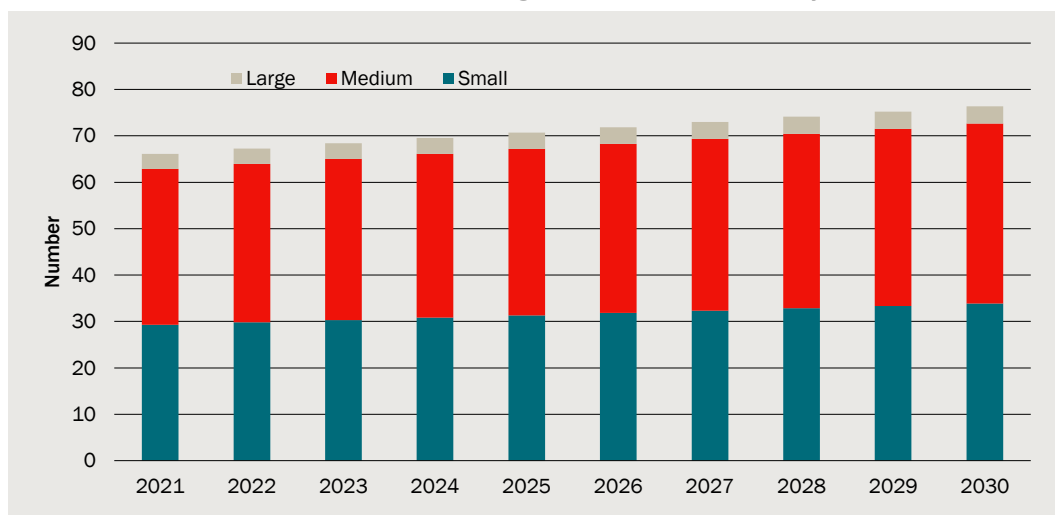
Dams Safety NSW previously estimated that the number of declared dams increases by around 7 per year. We assume that the composition of dams across each of the dimensions discussed above (i.e. consequence category, size and ownership) remains constant over time.

Requirement for competent persons to complete risk ratings

The estimated number of dams affected by the proposed regulation over time is shown in chart 4.3. This estimate is based on the following assumptions.

- As dam owners are required to complete a risk rating at a minimum of every 5 years (or in the other circumstances outlined in chapter 2), we assume that on average 20 per cent of dams (i.e. 1 out of 5) have a risk rating every year. This assumption may slightly understate the number of risk ratings per year, as some dams will have a risk rating prepared more frequently than every 5 years.
- In discussions, practitioners had broadly similar impressions of current practice.
 - Informed dam owners generally engage ‘competent’ practitioners to complete risk ratings (although ‘competent’ has not been clearly defined). This implies that the new regulatory requirement that risk ratings are carried out by competent persons will have no impact on these owners.
 - It is less clear that other dam owners would have sufficient understanding to ensure that the practitioner completing the risk rating would have the relevant qualifications and expertise. Some practitioners were particularly concerned about councils in regional areas that might rely on the local ‘generalist’ engineer, rather than an engineer with specific expertise. For the purposes of the CBA, we assume that the proposed regulations would have an impact on these owners.

4.3 Estimated number of dams incurring an additional cost per year



Note: Estimate assumes that: the proposed regulation would impact on 'other dam owners' only (i.e. informed dam owners are already likely to engage competent practitioners to prepare risk ratings); and on average 20 per cent of dams will prepare a risk rating in any given year.

Data source: CIE estimates.

The proposed regulation effectively restricts the pool of people who are able to undertake risk ratings. The impact may therefore be similar to an occupational licence, although the proposed requirement is not specifically an occupational licensing arrangement.

Restricting the pool of practitioners who are able to undertake risk ratings could effectively reduce competition and increase the cost of risk ratings for those owners that are not currently engaging a practitioner with the relevant competence to undertake risk ratings. Studies have shown that occupational licensing requirements can increase wages (and therefore costs) by around 5 per cent (see box 4.4).

4.4 The impacts of occupational licensing

A review of available studies found that the impacts of occupational licensing included the following.⁴

- Impact on prices — the report reviewed 11 studies on the impact of occupational licensing on prices. The studies covered: nursing, mortgage brokers and dentistry.
 - 9 of the 11 studies found that stricter licensing requirements resulted in significantly higher prices
 - The estimated impact on price ranged from a small (1 per cent decrease) up to and 16 per cent increase. The average across the various studies was 5.2 per cent.
- Impact on wages — basic empirical evidence suggests a significant wage gap between licensed and unlicensed workers. However, these wage gaps could reflect educational or other differences between licensed and unlicensed workers. When these differences are taken into account, the impact on wages is more modest and may be close to zero. The wage gap between licensed and unlicensed workers also appears to vary across industries.

An indicative cost of undertaking a risk rating for small, medium and large dams based on discussions with experienced practitioners is shown in table 4.5. Assuming that costs for affected dams would be 5 per cent higher due to the proposed regulation (see above) implies that the additional cost would be around:

- \$1500 for each affected small dam (mostly detention basins)
- \$3000 for each affected medium dam
- \$10 000 for each affect large dam (table 4.5).

4.5 Risk ratings – estimated cost impact

	Estimated cost	Additional cost due to regulation ^a
	\$	\$
Small	30 000	1 500
Medium	60 000	3 000
Large	200 000	10 000

^a Assumed that costs would be 5 per cent higher due to proposed regulation.

Source: CIE estimates based on: discussions with experienced practitioners; and The White House, Occupational Licensing: A Framework for Policymakers, July 2015, p. 60.

That said, the net effect is largely a transfer from dam owners to risk rating practitioners. Although there is typically some net loss (i.e. a deadweight loss) associated with price increases due to a restriction on competition, this typically relates to higher prices distorting the decisions made by users of the goods/services. However, the additional

⁴ The White House, Occupational Licensing: A Framework for Policymakers, July 2015, pp. 60-64.

cost of risk ratings is unlikely to materially change decisions relating to dams because: it is a regulatory requirement for dam owners to complete a risk rating (i.e. dam owners cannot choose not to undertake a risk rating); and risk ratings are a relatively minor cost in the context of other construction and operating costs.

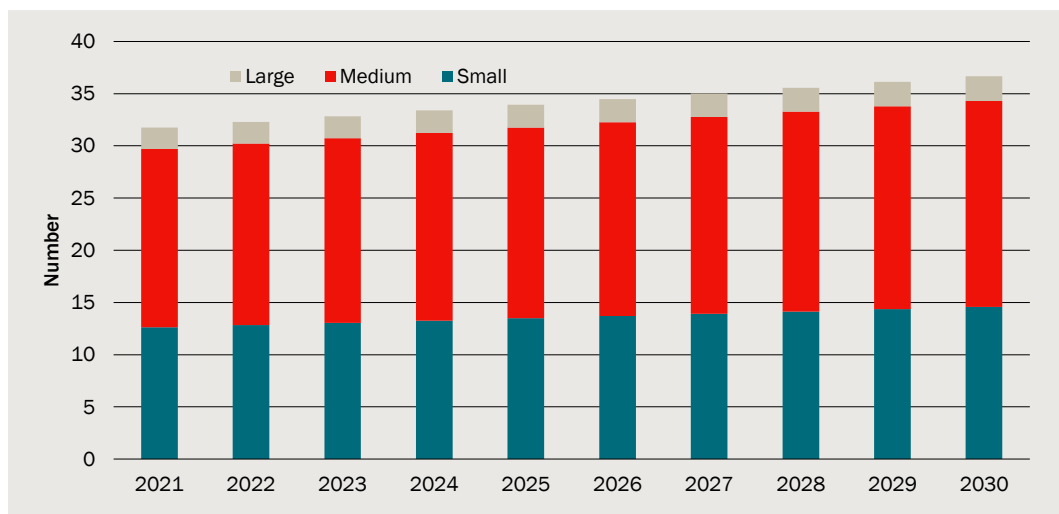
This implies that the additional cost to dam owners would be mostly offset by an increase in revenue to practitioners.

Review of risk ratings

A requirement for risk rating calculations to be reviewed by an independent competent person for extreme and high consequence category dams has also been proposed. The estimated number of dams affected by this proposal is shown in chart 4.6. This estimate is based on the following assumptions.

- As above, we assume that on average 20 per cent of dams (i.e. 1 out of 5) have a risk rating every year based on the requirement for a risk rating every 5 years. This assumption may slightly understate the number of risk ratings per year, as some dams will have a risk rating prepared more frequently than every 5 years.
- Discussions with practitioners also suggested the following in relation to current practice.
 - Informed dam owners are likely to have risk ratings reviewed by a competent person for extreme and high consequence category dams. We therefore assume no impact for these dam owners.
 - On the other hand, it is less likely that other dam owners would have risk ratings reviewed. These dam owners would therefore incur an additional cost under the proposed regulation.

4.6 Estimated number of additional risk rating reviews per year



Data source: CIE estimates.

Indicative cost estimates of a risk rating review for different sized dams based on discussions with experienced practitioners is shown in table 4.7.

4.7 Estimated cost of risk rating review

	Estimated cost of risk rating review
	\$
Small	7 500
Medium	17 500
Large	75 000

Source: CIE estimates.

Safety reviews

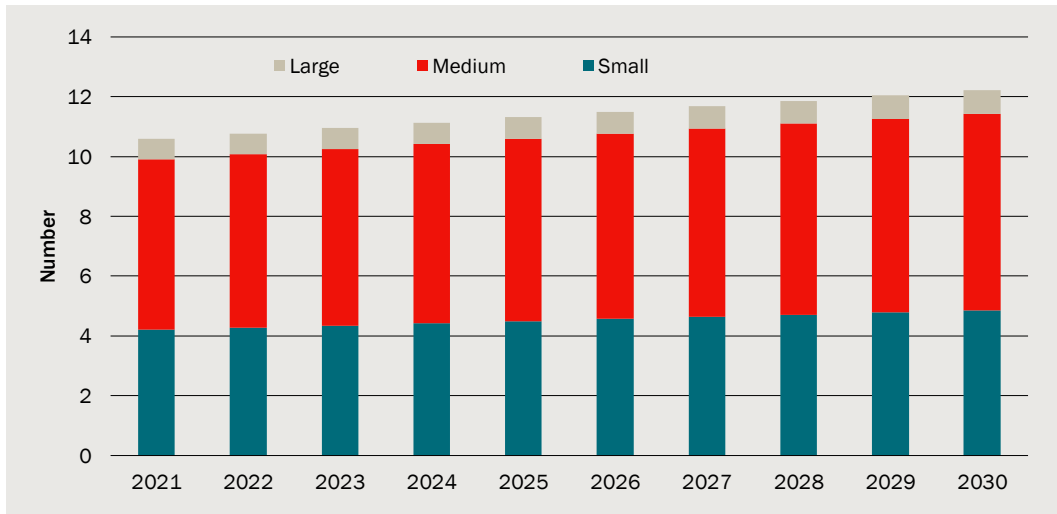
Safety reviews to assess the overall safety of a dam are required every 15 years.

- Under the current regulations, these safety reviews must be undertaken by a competent person.
- However, under the proposed regulation, the safety review for extreme and high consequence category dams must be undertaken by a panel of not less than 3 competent persons (covering expertise across the main areas of dam safety).

The number of dams incurring an additional cost associated with a safety review each year would be as shown in chart 4.8. This is based on the following assumptions.

- The requirement for a 15-year safety review would start from November 2021. Therefore, if there is no other triggering event, a dam owner has until 2036 to complete a safety review. Although there may be some safety reviews prior to 2036, most of the costs associated with this requirement would fall outside of the 10-year regulatory period used for the CBA. To avoid under-counting the potential cost impacts of the proposed change, we assume that on average, 1 out of every 15 dams undergoes a safety review every year. As above, some dams may undergo a safety review more frequently.
- As above, discussions with practitioners suggested the following.
 - Informed owners are likely to engage a panel of at least 3 competent persons, covering the range of relevant expertise to complete a safety review. These owners would therefore be unaffected by the proposed regulatory change.
 - Other owners are more likely to engage an individual who is unlikely to have relevant expertise across all areas of dam safety.

4.8 Estimated number of dams incurring additional costs per year



Data source: CIE estimates.

There would be a significant cost increase associated with having a panel complete a safety review, relative to an individual competent person. Based on discussions with practitioners, we assume that the cost would approximately double for the following reasons.

- The panel would cover the same issues as the single competent person; however, reflecting more specific expertise across each relevant area, a panel would cover these issues in more detail.
- There would be some duplication (for example, in the material that the panel would need to review).

An indicative estimate of the change in cost (based on discussions with practitioners) is shown in table 4.9.

4.9 Estimated increase in cost

	Single person	Panel	Change in cost
	\$	\$	\$
Small	30 000	60 000	30 000
Medium	75 000	150 000	75 000
Large	150 000	300 000	150 000

Source: CIE estimates based on discussions with practitioners.

Review of safety review

Under the proposed change to the regulations, safety reviews of extreme and high consequence category dams must be independently reviewed by a panel of not less than 3 competent persons, rather than an individual competent person, as is currently required.

Discussions with practitioners suggest that it is commonplace for safety reviews to be reviewed by a panel of 2 or 3, particularly among informed owners. However, smaller dams (such as detention basins) will often be reviewed by a single practitioner.

Practitioners suggested that the cost of a review would generally be proportionate to the number of reviewers. Some indicative costs for a review by the number of reviewers is shown in table 4.10. For the purposes of the CBA, we assume that:

- safety reviews of extreme or high consequence category small dams are currently reviewed by a single reviewer, implying a \$20 000 increase in costs under the proposed regulation
- safety reviews of extreme or high consequence category medium dams are currently reviewed by a panel of 2 reviewers, implying a \$20 000 increase in costs under the proposed regulation
- safety reviews of extreme or high consequence category large dams are currently reviewed by a panel of 3 reviewers, implying no change in costs under the proposed regulation.

4.10 Estimated change in costs

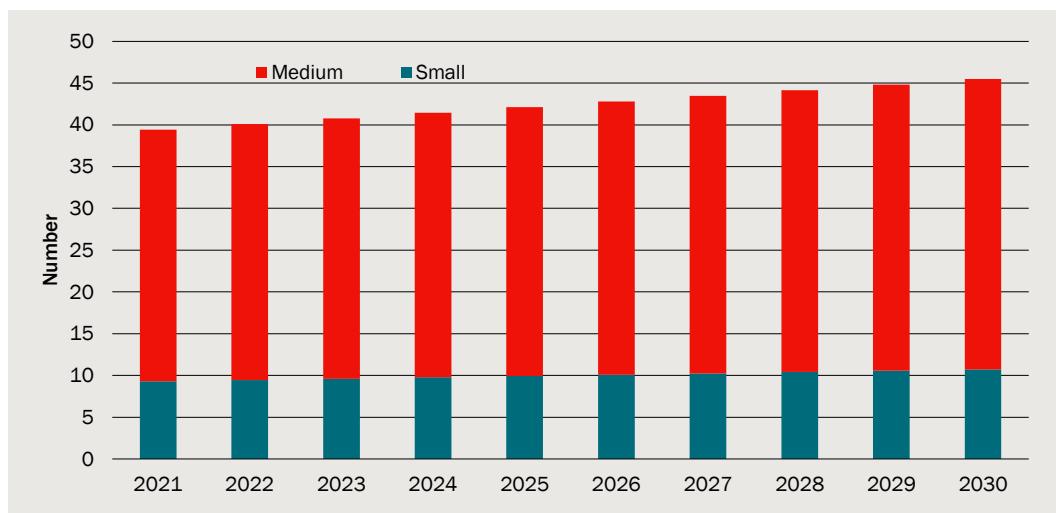
	Single person	2 people	3 people	Estimated change in costs
	\$	\$	\$	\$
Small	10 000	20 000	30 000	20 000 ^a
Medium	20 000	40 000	60 000	20 000 ^b
Large	30 000	60 000	90 000	0 ^c

^a Assumes that safety reviews of small dams are currently reviewed by a single reviewer. ^b Assumes that safety reviews of medium dams are currently reviewed by a panel of 2 reviewers. ^c Assumes that safety reviews of large dams are currently reviewed by a panel of 3 reviewers.

Source: CIE estimates based on discussions with practitioners.

Based on these assumptions, the estimated number of reviews of safety reviews incurring an additional cost per year over time is shown in chart 4.11.

4.11 Estimated number of reviews of safety reviews incurring an additional cost per year



Data source: CIE estimates.

Design checks

The proposed change to the regulation requires that the design of extreme or high consequence category dams must be checked by a panel of not less than three competent persons, rather than an individual competent person. The proposed regulation would presumably cover significant upgrades, as well as new dams.

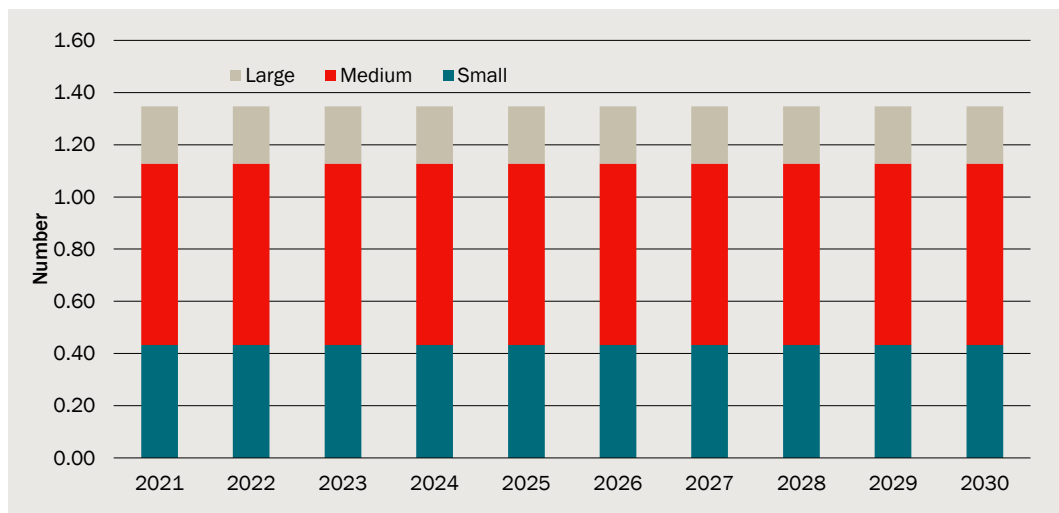
- Dams Safety NSW previously estimated that around 10 new dams are declared per year
- The Dams Safety Committee Annual Report for 2018-19 reports that 49 dams have had significant safety upgrades since 2001 (a period of around 19 years), although this list excludes tailings dams. This implies around 2.6 safety upgrades of existing dams per year.

Discussions with practitioners suggest the following.

- The design of **new** extreme and high consequence category dams would all be checked by a panel. Owners of these dams would therefore be unaffected by the proposed regulations.
- For upgrades of extreme and high consequence category dams, designs are likely to be checked by a single reviewer, implying a cost impact for these owners.

Based on these assumptions, on average around 1.4 dams per year would incur an additional cost associated with design review (chart 4.12).

4.12 Estimated number of dams incurring design review costs



Data source: CIE estimates.

Indicative estimates of the increase in costs for design checks (based on discussions with practitioners) are shown in table 4.13.

4.13 Estimated additional costs related to design checks

	1 reviewer	Panel	Change
	\$	\$	\$
Small	60 000	180 000	120 000
Medium	150 000	450 000	300 000
Large	250 000	750 000	500 000

Source: CIE estimates based on discussions with practitioners.

Benefits

The benefits from strengthening the regulatory requirements could include the following.

- Avoided remediation works to ensure a dam complies with relevant dam safety standards — independent review (particularly of dam designs) can avoid future remediation works (see Paradise Dam example in chapter 2).
- Avoided ‘gold-plating’ of dams — discussions with practitioners suggested that there is the potential for safety reviews and upgrade designs to lead to over-investment in safety (referred to as gold-plating). In particular, there have been cases where consultants (either deliberately or sub-consciously) do not recommend the most cost-effective solution (in some cases because this could lead to further work for the consultant). Discussions with practitioners suggested that reviews can result in more cost-effective solutions.
- Avoided costs associated with dam failures — in extreme cases, strengthening of the regulatory requirements could avoid a dam failure. Dam failures can impose significant (in some cases catastrophic) costs on the community including:
 - loss of human life
 - damage to private property
 - damage to infrastructure
 - loss of the services provided by the dam
 - damage to the environment.

It is not possible to quantify these benefits with any precision. That said, to the extent that the enhanced regulatory requirements avoid any of the outcomes discussed above, the benefits are likely to be large.

- The cost of a major dam failure could be in the billions of dollars.
- Remediation works on Paradise dam has been estimated at around \$700 million to restore the dam to full capacity.
- According to practitioners, a robust peer review process can potentially save tens of millions of dollars.

Risk analysis

In general, it is good practice to undertake sensitivity testing to:

- understand how sensitive the results are to alternative assumptions, and

- test the robustness of the results (i.e. would using an alternative assumption lead to a different conclusion).

As it has not been possible to quantify the benefits, formal sensitivity testing is also not possible. Nevertheless, we have tested the following scenarios.

Practices under the base case

A key factor driving costs is the extent to which the proposed changes to the regulation reflect current practice. Based on discussions with practitioners, the cost estimates assume that the proposed changes reflect current practice as follows.

- Well-informed dam owners engage ‘competent’ practitioners for risk ratings.
- Well-informed owners have risk ratings review by a competent practitioner for Extreme and High consequence category dams.
- Well-informed owners engage a panel of at least 3 practitioners with relevant expertise to complete a safety review.
- New Extreme and High consequence category dams would undergo a design check by a panel of 3 people with relevant expertise.

These assumptions limit the estimated cost of the proposed changes. However, if these assumptions are relaxed (implying that the proposed changes will affect all dam owners), the estimated costs increase to around \$51 million in present value terms over 10 years, using a discount rate of 7 per cent (table 4.14). This gives an upper bound estimate of the impacts of the proposed changes (although it is highly unlikely that the costs would be that high).

4.14 Estimated impact if proposed changes affect all dam owners

	Estimated cost to dam owners	Benefit to practitioners	Net impact
	\$ million	\$ million	\$ million
Risk rating	- 2.04	2.04	0.00
Risk rating review	- 22.82	0.00	- 22.82
Safety review	- 8.28	0.00	- 8.28
Review of safety review	- 6.33	0.00	- 6.33
Design check	- 13.58	0.00	- 13.58
Total	- 53.04	2.04	- 51.00

^a The additional requirements relating to risk ratings relate to who may undertake a risk rating. As such, the impact on dam owners relates to the price of services, rather than an additional requirements. As such, we assume that the cost to dam owners is offset by a benefit to practitioners.

Note: Estimates are presented in present value terms over the 10 year period (2021-2030), using a discount rate of 7 per cent.

Source: CIE estimates.

Break-even analysis

Break-even analysis can also provide some insights into the likelihood that the proposal will deliver a net benefit, even when the benefits cannot be quantified.

- As noted in chapter 2, the remediation costs relating to Paradise Dam were estimated at around \$700 million.
- The proposed changes are estimated to increase costs by around \$2.36 million per year (based on the number and composition of declared dams as at October 2020), although this increases over time as the number of declared dams is estimated to increase.
- The Paradise Dam case study provides the opportunity for break-even analysis.
 - A simple break-even analysis (abstracting from discounting issues) implies that the proposed changes would result in a net benefit if a scenario similar to the Paradise Dam scenario were avoided around every 300 years (note that an incident many years into the future would be heavily discounted).
 - Taking into account discounting, if the proposed changes to the regulation prevent an incident similar to the Paradise Dam case study at any time within the next (approximately) 45 years, the benefits would outweigh the costs.

5 Conclusion

Proposed administrative changes

The costs and benefits of the proposed administrative changes are difficult to estimate. That said, the additional administrative burden on dam owners is small and the costs are likely to be trivial.

Any benefits from more efficient administration of the regulatory regime is likely to outweigh any costs.

Proposed safety-related changes

The proposed safety-related changes to the regulations are essentially measures to ensure that key regulatory activities are undertaken (and where relevant checked/reviewed) by people with appropriate competencies. These changes will help to ensure the integrity of the new regulatory framework.

- To a significant extent, the proposed requirements reflect existing practice among well informed dam owners. However, there will be some additional costs on other dam owners. In general, these costs are relatively modest.
- As it is unclear to what extent these proposed changes will lead to better safety outcomes and cost savings, it is not possible to estimate the benefits of the proposed changes. However, the benefits are potentially large relative to the costs, even if the proposed regulatory changes lead to a better outcome for only one dam over the 10-year regulatory period.

On that basis, it is plausible that the benefits would outweigh the costs; however, it is not possible to be certain.



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