

# STANDING COMMITTEE ON STATE DEVELOPMENT

## INQUIRY INTO THE ADEQUACY OF WATER STORAGES IN NSW

### Supplementary Questions on Notice to the Dams Safety Committee

- 1. *Your submission notes that the DSC 'also has statutory obligations under the Mining Act 1992'. What are these obligations and how does the DSC meet them?***

One of the primary objectives of the NSW Dams Safety Committee (DSC) is to ensure that risks to the security of prescribed dams and their storages, from mining activity, are acceptably low. The DSC has statutory functions under the Mining Act 1992 where, through advice to the responsible Minister, the DSC plays a role in determining the type and extent of mining (predominantly coal) allowed near prescribed dams and their storages.

The Committee has the ability to arrange for amendments to existing mining leases under Section 80 of the Mining Act by making a recommendation to the Minister administering the Mining Act. The DSC is only restricted in that the recommended changes are to prevent or mitigate any damage to a prescribed dam. The DSC will endorse mining around or under dams where it can be demonstrated to its satisfaction that mining will not have a significant adverse affect on the safety of the dam or the security of the stored waters.

The DSC Guidance Sheets on dam safety management, including those related to mining activities below or near prescribed dams and their storages, are readily available on-line at the DSC's web site, <http://www.damsafety.nsw.gov.au> There is a series of four sheets on requirements pertaining to the management of such mining – *DSC4A to 4D*. These deal respectively with administrative procedures, mining applications, management & monitoring matters and contingency plans.

Specifically, in relation to mining in the vicinity of prescribed dams, the DSC will not allow mining that would reduce the safety of the dam structure to a level below the Committee's current requirements. An appropriate margin of safety, based on the importance of the dam structure, its construction and its Consequence Category, will also be incorporated into any approval. Where the consequence of damage is great, the DSC will generally not permit any damage to the structure.

When considering the stored waters of prescribed dams, mining will be endorsed where it can be demonstrated that no significant loss of storage would be expected. The importance of the storage will determine the margin of safety required for the proposed mining. Less conservative mining may be endorsed where it can be demonstrated that:

- Loss of storage will be minimal compared to the safe draft of the reservoir; and
- Particular research projects will be undertaken associated with the mining, which will improve knowledge of the mining effects beneath stored waters.

The DSC can regulate mining via a number of mechanisms. The usual mechanism is by inserting conditions into a mining lease (Prescribed Dams Conditions) which then require the leaseholder to seek special ministerial approval to mine within a

Notification Area (NA) – i.e. a “mining approval”. The Minister has the discretion to accept or reject the DSC’s advice in regard to mining approvals.

The DSC will define Notification Areas around certain prescribed dams and their storages under Section 369 of the Mining Act. They have the following two purposes:

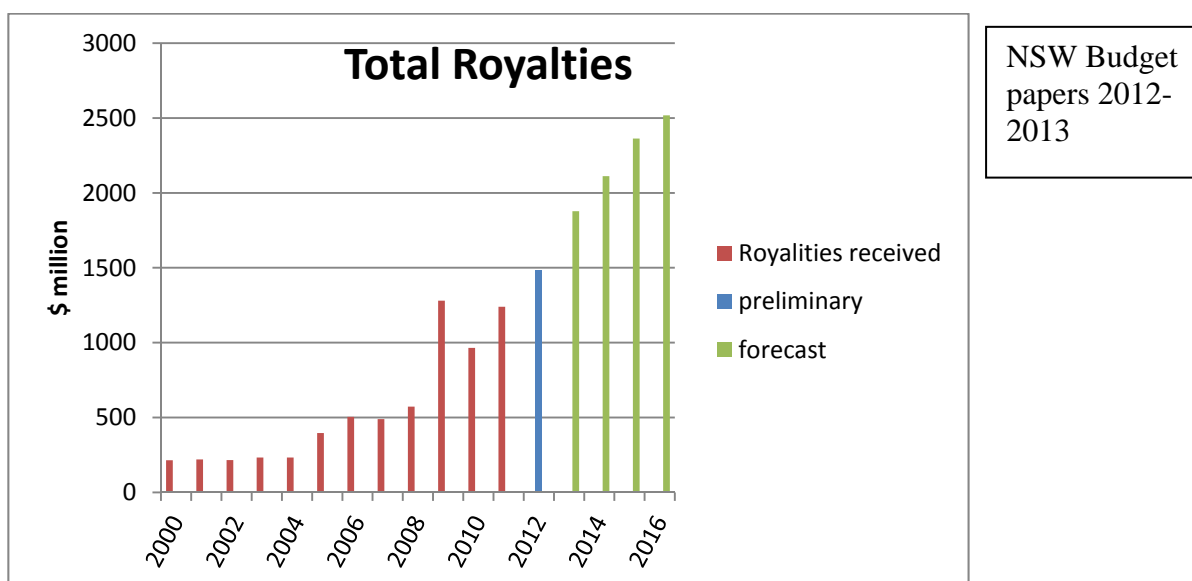
- To require (by virtue of the Mining Act) the Department of Primary Industries (DPI) to submit proposed mining leases that fall within NAs to the DSC for comment prior to grant; and
- To require (by virtue of the lease conditions) mining lease holders to apply for ministerial approval to mine within a NA (a “mining approval”).

The consequence of defining a Notification Area is that proposed Mining Leases that overlap a NA must be referred to the DSC prior to the lease being granted. This allows the Committee to propose conditions, or object to the granting of the lease, on grounds relating to the safety of a prescribed dam.

The DSC makes recommendations to the Minister administering the Mining Act on the extent and type of coal mining to be permitted in the vicinity of prescribed dams, and in doing so balances the need to maintain the integrity of the dam and its storage with the need of the mine operator to extract valuable coal. This competition between potential users of the two resources (i.e. coal and catchments) is particularly prevalent south of Sydney with extensive coal reserves below Sydney’s drinking water supply. Mines with coal leases below Sydney’s water supply storages include: Dendrobium, NRE No1, NRE Wongawilli and Metropolitan.

The experience of the DSC regarding mining beneath dams and their storages has been that controlled mining will not pose a threat to the safety of the dam. Any proposal needs to be considered after a careful review of the specific geology, topography and mine layout. An appropriate monitoring programme is also important to ensure that unexpected conditions are dealt with before they get out of control.

Future projections from the NSW Treasury in Budget 2012-13 indicate that following a brief downturn due to the GFC in 2009-2010, the mining industry is back in full recovery mode and with government royalties collected from the NSW minerals sector projected to soar over the period 2014 to 2016 (see figure below).



The NSW Budget papers state that around 95% of royalties are derived from coal. With some 20 million tonnes of coal extracted from within Notification Areas during 2011-12, a conservative estimate of the value to the State of this coal would be \$190M. This income is increasing as revealed by the significantly upward trend in tonnes of coal extracted under approval from within Notification Areas around dam storages. This has been significantly helped by the substantial number of review and application approvals of mining activities under/near dams undertaken and reviewed/processed by the DSC as part of overall government approval procedure.

**2. Your submission states that the 'DSC expects the number of prescribed dams in NSW to continue to grow and existing dams to require safety improvements to meet community expectations'.**

**a. Why do you anticipate that the number of prescribed dams will grow, and where do you anticipate that this growth will occur?**

The trend of an increasing number of prescribed dams over time has been evident for many years. At the time of the original proclamation of the Dams Safety Act in 1978 there were 148 prescribed dams. By 1986 the number of prescribed dams had increased to about 200 and by 2002 had increased to about 290. It has since risen further to about 380 currently. Given this net increase of about 90 prescribed dams in the last 10 years, the average net increase during the decade 2002-2012 is therefore 9 prescribed dams per year. Retarding & detention basins and mine tailings dams represent the majority of this increased number of prescribed dams during the last decade.

Other than various mine water dams, water supply dams constructed since 2000 include the following:

- Steuart McIntyre Dam (24m high; 2,500ML) near Kempsey, in 2000;
- Tumut Paper Mill Freshwater Dam (27m high; 190ML) in 2001;
- Cowarra Dam (41m high; 10,000ML) south of Wauchope, in 2002;
- Barden Ridge Lower Dam (22m high; 36ML) near Menai, in 2007;
- Shannon Creek Dam (51m high; 30,000ML) near Grafton, in 2009.

An off-stream storage dam near Nambucca is now at design completion stage.

Given the historical long term and recent increasing trends (as noted above), the DSC expects that the number of prescribed dams will continue to grow – particularly for the following reasons:

- The current on-going significant activity and development in the mining industry, involving the continued evolution of mine tailings and storage dams.
- Investigation and development of coal seam gas extraction – which will require some holding reservoirs for the water that is obtained as part of the extraction process.
- Additional prescribed dams resulting from the on-going responses to the DSC's program of questionnaires to Local Government and from other investigations that DSC may undertake looking for existing dams that should have been prescribed. Many such of these dams are likely to be flood retarding basins and also some significantly sized farm dams.
- All new housing development areas are required to provide storm water systems to ensure there are no deleterious impacts from the significant increase in runoff from the new residential and commercial buildings. This

often results in the construction of new detention basins in close proximity to the new properties and/or existing residential and other properties.

**b. In general, what are the main safety improvements required to existing dams?**

The main safety improvements typically required include the following works:

- Provision of filters (especially to the upper parts of embankment dams) to reduce the risk of piping failure of earthfill and earth & rockfill dams;
- Provision of increased flood passing capacity by adding auxiliary spillways, increasing the discharge capacity of existing spillways, increasing the dam height or combinations of the foregoing.
- Strengthening of older concrete gravity and arch dams to handle modern dams engineering/industry acceptable stability and condition criteria – with respect to hydraulic, uplift and structural actions (including seismic loading). Improvement methods generally include the following:
  - vertical/sub-vertical post-tensioned ground anchors;
  - various means of buttressing the downstream dam face;
  - drainage works and other foundation treatment.

**3. Your submission states that the DSC takes an ‘active role’ in setting the requirements for the design and construction of new dams and upgrading of existing dams.**

**a. What role does the DSC play, and what requirements are taken into consideration?**

The DSC’s prime goal is to ensure that all prescribed dams in NSW are designed, constructed and operated to a standard where risks to the community are tolerably low. The level of risk is determined by the likelihood and consequences of failure.

The DSC ensures that dam owners follow world’s best practice; and has introduced policies (the risk framework of dam safety management) that will reduce risk to the required tolerable levels whilst recognising the need for cost effective and practicable solutions.

The DSC’s approach to dam safety is goals-based as far as practicable, with its prime goal being that dams (including retarding and detention basins) meet the DSC safety requirements as generally set out in its Guidance Sheets. Design and construction aspects necessarily form significant parts of the dam safety requirements. The Guidance Sheets were updated significantly in 2010, including suitable incorporation of the adopted risk framework approach where applicable.

The recognised safety levels embodied in the Guidance Sheets have been determined by the DSC, based primarily on a constructive critical review of relevant Australian National Committee on Large Dams (ANCOLD) guidelines and with critical consideration also given to:

- International Commission on Large Dams (ICOLD) publications;
- Guidelines of other national dams engineering associations;
- Practices of other Australian and international dam safety regulators;
- Authoritative good practices of leading dam owner and dam engineering organisations.

The DSC Guidance Sheets are readily available on-line at the DSC's web site. As well as the background sheets *DSC1A & 1B* and the series of dam safety management general requirements sheets *DSC2A to 2I*, there is also a series of sheets on particular requirements – *DSC3A to 3G*. The first six of the *DSC3* series cover consequence categories, acceptable flood capacity, acceptable earthquake capacity and spillway flow control systems; and (specifically) flood retarding basins and tailings dams. Amongst other things, these *DSC3* sheets encompass key design and construction aspects. *DSC3G General Dam Safety Considerations* assist owners implementing a new dam (or modifying an existing dam) by listing common design, construction and operational issues which the DSC considers to be good practice for most situations, but which are sometimes neglected or inadequately covered in submissions to the DSC and/or are not covered in detail in other DSC documents. Like other sheets, *DSC3G* is not intended to be a comprehensive design manual. The full responsibility for all phases of dam safety management rests with dam owners and their professional advisers. Accordingly, the DSC will consider carefully any well documented case supporting the use of alternative approaches.

***b. What interaction does the DSC have with government agencies responsible for the management of water, such as the Department of Primary Industries or the Sydney Catchment Authority?***

The DSC liaises with the NSW Office of Water (which is within the DPI) and discusses with all dam owning government agencies their strategies for ensuring effective dam safety programs.

Under the current provisions of the Dams Safety Act, the Committee Members to be appointed by the Minister include a nominee of Snowy Hydro Limited and nominees of the following government agencies/corporations that also have substantial storage portfolios and responsibilities for the management of water:

- Sydney Catchment Authority (SCA);
- State Water Corporation (SWC);
- Hunter Water Corporation (HWC).

As part of the existing working practices of the DSC, the above mentioned three government agencies/corporations each have a representative on the standing Surveillance Sub-Committee. The SCA and SWC also each have a representative on the Emergency Management Sub-Committee, whilst the standing Mining Sub-Committee includes a representative of the SCA.

As further part of the existing working practices of the DSC moreover, the SCA and HWC Committee Member nominees are part of the 5-member Policy Sub-Committee that meets occasionally on an as-needs basis.

***4. Your submission indicates that the DSC is progressively implementing a risk management framework for dam safety management and planning of dams.***

***a. What is this risk management framework, and what are its advantages?***

The DSC risk management policy framework for dam safety framework was developed by the DSC and endorsed by the NSW Government in August 2006. The policy framework and its background context are explained in Guidance

Sheet *DSC1B*, available on the DSC's web site. *DSC1B* outlines the framework's high level generic principles and provides accompanying notes, tables and figures that amplify the principles or indicate their application.

The DSC "normal" safety requirements for dams define positions generally acceptable to the DSC, with the starting points in assessment of long-term safety being:

- The safety level at the conservative (safer) end of any ANCOLD range for the standards-based approach (SBA) requirements, where such exist.
- Where there is no SBA, compliance with the DSC public safety risk guidelines.

It is emphasized that the DSC's overriding policy is to determine its safety requirements on the merits of any particular case and will thus consider submissions by owners for departure from the DSC's normal safety requirements on a case-by-case basis. Owners would need to demonstrate that risks are tolerable for the time being, or will be tolerable following proposed safety improvements. Some of the other main principles DSC's framework for the assessment and management of dam safety risks include the following:

- The DSC adopts the national standard Risk Management, *AS/NZS 4360* as defining the framework for assessment and management of dam safety risks. Traditional dam engineering standards are absorbed into that framework.
- A dam owner is to keep the risks of a dam under review.
- For risks to public safety and other community interests to be tolerable, an owner will need to use a risk assessment approach to demonstrate that the overall risk is below the DSC limit of tolerability and as low as reasonably practicable (ALARP). [Note: For public safety risks, the key risk boundaries in applying the ALARP test – the limit of tolerability and the negligible level of risk – are defined in words and graphically in coloured figures in *DSC1B*.]
- A dam owner is to bring risks into compliance with the DSC's safety requirements as soon as reasonably practicable.
- Safety improvements required by the DSC may be implemented progressively (i.e. staged upgrades) where that would promote more effective risk reduction for the community, but in such cases progressive implementation is subject to DSC review.
- Owners of several dams requiring safety upgrades may also use portfolio risk assessment to assign priority and urgency of staged dam upgrades across their portfolio, subject to DSC review.

The DSC encourages the use of dam portfolio risk assessment and/or risk index schemes by dam owners as a basis for reviewing the priority and/or urgency of dam safety studies and improvements. The DSC requires that risks to the interests of the community will be a key factor in the assignment of priority and urgency of staged upgrades for a dam or across a dam portfolio – whilst however recognizing and noting the influence of other considerations, including the cost effectiveness of risk reduction measures and the economic and technical practicality of various measures.

In undertaking risk assessment as part of the risk management framework, dam owners are to follow the ANCOLD *Guidelines on Risk Assessment*, and the relevant parts of DSC Guidance Sheet *DSC2D Demonstration of Dam Safety*.

The advantages of a risk management framework approach include the following:

- It addresses shortcomings of the standards-based approach (SBA). For example:
  - the SBA gives no or limited guidance on piping in existing earthfill dams and earth & rockfill dams. (Piping is a potentially hazardous internal erosion condition that may develop in embankments or their foundations.)
  - the SBA cannot account quantifiably for the role of human errors in contributing to the likelihood of dam failure.
  - the failure modes assessment which is part of the risk assessment process can throw up potential failure modes for which there are no adequate SBA requirements.
- It may allow an owner to demonstrate that less costly safety improvements than those required by a SBA or another deterministic approach would adequately protect public safety and community interests.
- It allows for progressive improvement across all the dams presenting intolerable risk in an owner's portfolio rather than bringing one dam at a time up to the final standard – e.g.
  - increasing the spillway capacities for all the Extreme Consequence Category dams to part of the probable maximum flood (PMF) as the first stages of a portfolio upgrade program; and
  - with the subsequent stages of the program to further increase the spillway capacities up to a required standard (e.g. satisfying the PMF for an Extreme Consequence Category dam).
- It can allow for more informed and enhanced decision making.

**b. What action does the DSC take if a dam is deemed to be unsafe?**

The DSC talks to and liaises with the dam owner and elicits a dam improvement program from the owner following appropriate studies by the owner's consultants to determine appropriate upgrade options and to recommend a practicable and cost effective solution.

Section 18 of the Dams Safety Act refers to the giving of notices to ensure the safety of prescribed dams. Subsection (1) states that:

*“Where it appears to the Committee that a prescribed dam is unsafe or is in danger of becoming unsafe, the Committee may, by notice in writing, require the owner of the prescribed dam to do such things as are specified or described in the notice as maybe reasonably necessary to ensure the safety of the prescribed dam.”*

Section 19 of the Dams Safety Act refers to inquiries that could be initiated if necessary. Subsection (1) states that:

*“The Committee may, and if directed to do so by the Minister shall, conduct an inquiry into any matter relating to the safety of a prescribed dam.”*

**5. The submission we received from Professor Stuart Khan at the University of New South Wales discussed the dual role that dams can play in both water storage and flood mitigation (Submission 25, p 2). Do you have any comments on this dual role of dams?**

Multi-purpose dams are common world-wide. A number of the prescribed dams regulated by the DSC are multi-purpose. This does not present a particular problem to the DSC – as long as the owner adheres to the usual dam safety principles and other requirements of the DSC.

A notable example of a large dam in NSW which has a major water supply (mostly for irrigation) and flood mitigation dual role is Burrendong Dam on the Macquarie River near Wellington and owned by the State Water Corporation (SWC). It has a substantial radial gated storage volume above its full supply level (FSL) dedicated to flood mitigation. The storage capacity at FSL is 1,190,000ML and the flood mitigation storage above that is 490,000ML. SWC would be able to advise on how the storage is generally operated.

It is noted from recent newspaper reports (including the *Brisbane Times*, 24<sup>th</sup> July 2012) that the Qld State Government has stated it has no short term plans to reduce the storage levels of southeast Qld dams – most of which are currently at or close to full capacity, including the largest and strategically most important Wivenhoe Dam (which has a dual water storage and flood mitigation role). This is because the Bureau of Meteorology is predicting a drier than average wet season this year.

**6. One of the terms of reference for the inquiry asks us to consider water storages and management practices in other jurisdictions. Are there any other jurisdictions or countries that you look to for best practice or innovative ideas regarding dam safety?**

The Health and Safety Executive (HSE) in the UK was an early developer in risk management principles. BC Hydro is one of the largest and most influential dam portfolio owners and managers in Canada and was an early developer of risk assessment principles for dams. The early developers and practitioners of dam risk assessments in Australia had contact and close liaison with those and other relevant international authorities and also examined public safety management practices in other hazardous industries. Organisations such as the US Bureau of Reclamation (USBR) and the US Army Corps of Engineers (USACE) are now using risk management principles for their dams. These large engineering organisations are two of the most widely recognised influential authorities within dam engineering internationally. As well as occurring within NSW, risk management for dams is now being applied in various government/engineering authorities in several of these major developed countries.

The DSC (and Australian dam engineering practice in general) takes many of the ideas on dam safety management from the USBR. However, there has been original research carried out at the University of NSW over recent years (particularly for or in association with the USBR), and that has led to innovations in dam safety management practices both here and overseas.