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Submission details

I am making this submission as A member of the general public

Submission type I am making a personal submission

Organisation making the submission (if applicable) NA

Your position in the organisation (if applicable) NA

Consent to make submission public I give my consent for this submission to be made public

Share your experience or tell your story

Terms of Reference (optional)

The Inquiry welcomes submissions that address the particular matters identified in its [Terms of Reference](#)

1.1 Causes and contributing factors	Not specifically addressed
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1.2 Preparation and planning	Addressed
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1.3 Response to floods	Addressed
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1.4 Transition from incident response to recovery	Not addressed
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1.5 Recovery from floods	Not addressed
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1.6 Any other matters	Potential for recommendations to be made by the Inquiry for alterations to management arrangements (eg agency amalgamations, transfer of responsibilities between agencies)
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Supporting documents or images

Attach files	<ul style="list-style-type: none">• Submission to the 2022 NSW Flood Inquiry.docx
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Submission to the 2022 NSW Flood Inquiry

Chas Keys

Introduction

This is a private submission to the Flood Inquiry: I am not formally a part of any organisation which was involved in the management of this year's floods in New South Wales. However, for fourteen years between 1990 and 2004 I was employed by the New South Wales State Emergency Service (SES) firstly as its State Planning Co-ordinator and later as the Deputy Director General (nowadays Deputy Commissioner). Many of my responsibilities in both these positions related to planning for the occurrence of flooding but I also had considerable involvement in operational decision making when floods were occurring. Upon my retirement from the SES I established a new career as a flood management researcher and consultant undertaking projects in Queensland, NSW, Victoria and South Australia and on behalf of the federal Attorney-General's Department. In undertaking these projects, I was well served by my background in the SES planning for floods and managing flood operations.

The experience and expertise I developed in these roles over more than 30 years of professional involvement in the field may be of interest to the Inquiry. At the end of this submission, I provide further detail on my background in and knowledge of matters related to the management of flooding.

In the submission I deal with only a few of the matters that have arisen in NSW as a result of the floods of 2022. I was not a personal witness to the flooding that has been experienced in the state this year and I am not in a position to comment on such matters as the adequacy or otherwise of the real-time agency and community responses to it.

My observations therefore will be confined to only three broad areas of relevance to the Inquiry. These are the SES's planning for floods, the potential for managerial arrangements defining agency flood-related responsibilities to be altered in the future, and state policies as far as land use management on floodplains is concerned.

Planning for Floods: the SES Record

The NSW SES was founded in 1955 in the wake of severe floods in much of the state that year and back to about 1949. This was a particularly 'flood-rich' period in the state's history and many flood records set in those years (for example, heights reached at stream gauges) have not since been surpassed. Much of the flooding experienced was of a very severe nature, with many deaths and great material losses occurring especially in the Hunter Valley and the Northern Rivers but also in the west, metropolitan Sydney and on the South Coast. Few parts of NSW did not experience severe flooding during that period.

The SES was constituted from its inception as the state's flood agency for the real-time management of the problems which flooding brought. Years after its formation, the organisation was defined in state legislation (the State Emergency Act 1989) as the 'combat

agency' for floods. The SES's role in co-ordinating community and agency responses during times of flooding in NSW was formalised in this Act.

The activities the SES was from the outset involved in included the resupplying of communities and individuals cut off by floodwaters, expedient mitigation activity to protect buildings and critical elements of infrastructure (usually by sandbagging), the warning of impending flooding (including the provision of information and advice to community members), the rescue of people in imminent danger from floodwaters and the evacuation of community members (occasionally in large numbers) to safer places. Many of the tasks which these activities involve cannot be carried out to optimal effect without thorough training and careful preparation and planning, best undertaken well in advance of the arrival of floodwaters. In the SES's early years there was much emphasis on these matters. Liaison with community groups and leaders about the needs of people who were experiencing floods and suffering the many consequences they brought was also regarded as important in framing the SES's activity. This liaison was an essential input to effective planning for conducting the tasks that were to be carried out when floods struck.

The Decline of Planning

During the later 1970s and the 1980s, however, the SES's focus on and attention to flood planning and on the consultation which had underlain it declined. The result was that responses to floods were increasingly undertaken without significant planning for them having been conducted beforehand. This was a case of the SES 'losing its way' in relation to the carriage of its responsibilities to lead and co-ordinate community flood response efforts. The consequences of this loss of direction were to lead to the SES being forced to modify the way it approached its mission.

The 'drift' away from planning for flood management from the late 1970s led to severe criticism of the organisation (Office of Public Management, Premier's Department, 1989). The OPM saw dangers in what had been happening: its review found the SES to have "critical deficiencies". The organisation had been "mismanaged" and was "unable to provide the skills and leadership needed" to perform its functions. In particular the lack of planning for floods was singled out and excoriated in harsh terms.

The OPM's report concluded that there were "no plans of real significance in existence". Planning had been reduced to a minor role, as was indicated by the fact that the employed staff of about 100 at State Headquarters and in the regional offices included only a single person with a defined role in relation to planning for floods. Lacking leadership from staff with planning expertise, little planning was being done by local volunteers either. The habit had formed of the SES simply 'reacting' to floods as they occurred. Warning had become a minor function, the focus going to rescue and resupply activities conducted largely by floodboat and to sandbagging.

The potential for complex, large-scale evacuation operations to be needed in centres like Lismore, Maitland, Moree, Wagga Wagga and many other places, including the western suburbs of Sydney (where tens of thousands of people in the valleys of the Hawkesbury-Nepean and Georges River valleys lived on floodplains), was largely being ignored. These places all had substantial development on floodplains, with many workplaces and important community institutions exposed to flooding along with much residential housing.

Important property-protecting, rescue, resupply and evacuation tasks were being carried out by volunteers during floods, and the OPM recognised the valuable work that was being conducted by the SES's thousands of volunteers in the local units. But managerial functions conducted largely outside flood times and requiring professional planning skills, experience and leadership were being given only minimal attention. The SES's State Headquarters, the review concluded, had failed.

The Resurrection of Planning and the Use of 'Flood Intelligence'

As a result of the review, the SES was radically restructured and redirected. Planning for floods was given a high priority once more. As a direct consequence, flood plans were prepared over the period 1990-95 for all local government areas in New South Wales which could be said to have a significant problem of flooding: in practice this was almost all of them. The plans were initially prepared by a State Headquarters planning unit initially of three people, gradually expanded over time to incorporate by 2007 eight members at State Headquarters but also involving staff in the regional headquarters and senior volunteers operating in the units at the local level.

The plans themselves covered all foreseeable response tasks for all potential levels of flooding (including those of a scale beyond what had been experienced), the co-ordination of the activities of other agencies and volunteer organisations and the education of the members of flood-affected communities about how they could deal with floods in their own interests. Coping strategies advised included protecting items of property (by raising them *in situ* or transporting them for temporary storage off floodplains) and evacuating when necessary and as advised by SES personnel or the Police.

The planning that was undertaken from 1990 onwards incorporated the building up of 'flood intelligence' (mainly information on the impacts of flooding at specified gauge heights). This intelligence, derived from past floods and from floodplain management studies conducted by consultants, was vital to the effort. In association with Bureau of Meteorology flood forecasts for key locations on the state's rivers and creeks, it guided local response decisions and the undertaking of the warning function.

Gradually, as the SES became more accustomed to and confident in its use, the intelligence became more central to operational management both in terms of decision making and in communicating to community members what could be expected to happen in their own areas in a developing flood and what individuals should do to stay safe and protect items of property. Beyond those purposes, it helped demonstrate to SES personnel the nature of the interaction between floods and communities. Indeed it played a part in building the organisation's 'flood management culture' and it unlocked the 'manageability' of floods by providing in advance a picture of what a coming flood would do in terms of consequences.

Planning was also undertaken to facilitate doorknocking operations as floods were approaching, and the teaching of local SES volunteers about the management of sometimes highly complex operational tasks including mass evacuation was provided. This latter function is critically important in many parts of the state even though almost by definition it is required only infrequently in individual locations. Large-scale evacuation cannot be well managed without considerable prior thought, the results of which can be written down in plans and reviewed periodically to ensure it remains fit for purpose in guiding future operations. Finally, educational resources were assembled to help community members

understand the problems they would face when floods struck and to carry out their own responses to protect belongings and to maintain personal and family safety.

Many discussions about the 'how' of these things were conducted between volunteers, regional staff and planning staff, and consistency and quality of practice was consciously promoted throughout the state. NSW became a leader in flood planning endeavours in Australia and much of what was developed as appropriate practice was eventually adopted in other states.

Decline, once More

Eventually, though, during the second decade of the present century, the role of flood planning in the NSW SES fell away again and as an activity it was marginalised once more. Local flood plans became outdated, planners were not replaced when they moved on and eventually the State Headquarters planning unit (titled the Emergency Risk Management Section) itself was disbanded. The planning function was devolved to the regional offices, not always to staff members with appropriate expertise, and with little if any oversight from State Headquarters which now lacked the planning experience to provide the needed leadership.

As things currently stand in NSW, some local flood plans have not been reviewed for 15 years. Plans have gathered dust on shelves, and to all intents and purposes planning in some parts of the state has ceased to exist except insofar as it is undertaken during real-time flood operations. The written planning documents themselves, it seems likely, now have only a limited role in informing real-time flood management responses.

All this represents the experience of the 1980s being repeated. As before, the consequences of the marginalisation of the planning function have been many and serious and they have become increasingly evident. The organisation's culture of preparedness has been impaired and new volunteer and staff members are increasingly unacquainted with the learning opportunities that planning provides. Likewise the knowledge gained from past flood management experiences and incorporated in written documents is being or has already been lost.

SES activities during floods appear to have taken on something of the 'knee-jerk' character of crisis management. In this situation there is a risk that each new flood will to a degree be treated as an event without antecedents from which today's flood operatives in the SES could have learnt.

It must be made clear that the decline of flood planning discussed here is not a particularly recent phenomenon. It has been going on since about 2013 or 2014. In other words, the responsibility for the slide does not lie with the current leadership of the SES though one might argue that that leadership could have done more to recognise what has occurred.

The Importance of Planning Re-Stated

Planning is a vitally important function in organisations which have responsibilities for the management of emergencies that have the potential to claim lives and cost people dearly in material terms. It helps practitioners, staff and volunteers alike, to come to grips with the tasks they must perform. It educates them by forcing them to confront problems in advance, and it helps them to see their own roles in the wider context of the overall

management effort. This effort incorporates many agencies and indeed the members of whole communities at risk from the difficulties which the flood hazard presents.

To lose a strong focus on planning is to lose a vital tool in carrying out the management role. This can be said to apply alike to SES practitioners and to community members likely to be affected by flooding.

It has, of course, always been a challenge to persuade people who live or work on floodplains to plan for events they do not necessarily anticipate even though there are some inevitabilities associated with living or working on floodplains. Most people, despite exhortations from the SES, simply do not undertake such planning activity and of the roughly ten per cent of Australians who reside on floodplains the proportion who have put together workable private flood plans is distinctly small. Sadly, the problems are too often not appreciated by those who will bear them until they actually occur.

The NSW SES in the early 2020s (like the SES of the 1980s) appears through misguided leadership roughly between 2013 and 2019 to have drifted away from recognising the importance of flood planning processes and the plans that those processes create. It is difficult to over-state the significance of this matter or the urgency with which it should be addressed. A well-known emergency management saying which carries more than an element of truth has it that “to fail to plan is to plan to fail”. In this, today’s SES appears is at some risk.

Management Arrangements

Recent comments in the media and before the NSW Legislative Council’s ‘Select Committee on the Responses to Major Flooding across NSW in 2022’ imply that there is live consideration being given in some quarters to altering current, long-standing arrangements about agency involvement in the management of flooding. Some of the opinions expressed over recent months represent views that have existed for many years, and they have often been aired after response and recovery activities have been shown to have been carried out to less-than-optimal standards of performance.

Imperfection, of course, is to be expected in the management of emergency situations: flood and other emergency operations are conducted under difficult circumstances which often create considerable stress to individuals and to management systems. The environments which are being managed are not functioning as they usually do and they are often beset with uncertainties which must be dealt with in the absence of complete knowledge and understanding. Emergency management is a very difficult undertaking.

There are three principal matters to be examined here. They are the potential amalgamation of the SES and the Rural Fire Service, a hardy perennial for many years, the notion that Fire and Rescue NSW should take over the leadership of flood management as traditionally performed by the SES, and the impact of the SES’s Zone structure on operational effectiveness.

Merging the SES with the RFS

The merging of these two volunteer agencies is frequently mooted and it has on one occasion been attempted. That was in 1975 and it failed badly, leading quickly to a reversal.

The members of the then Bush Fire Brigades objected to being 'absorbed' by the SES and placed under SES control, and a political campaign to reverse the merger decision and create a separate department dedicated to bush fire management was successful. The two organisations have always been culturally different, and their concerns differ notwithstanding the fact that both are focussed on emergencies derived from agents of natural disaster. The two hazards are different in many ways and the reasons why people join the two organisations are not identical: many RFS members do so to protect their own interests on farms. There is complex psychology at play here which must be understood if changes to management structures are to avoid causing unintended negative consequences.

Very likely, an amalgamation of the two agencies now would marginalise the management of floods: bush fires, because of the greater sense of danger and dread they evoke, have always ranked higher in importance than floods in both the public mind and in governmental circles. The relative budgets of the SES and the RFS have long demonstrated this even though floods in annual average terms cost more by way of dollar losses in this state than do bush fires, something which is not widely understood in the community. Nor is the fact that floods are more manageable than bush fires in terms of the damage and loss that can be avoided well appreciated. Flooding is often described as the 'most manageable' of the hazards of nature because the locations of impact can be known in advance with some certainty and there is usually time to organise responses to it.

These things are much less true of bush fires, tropical cyclones, hail and wind storms, tsunami and landslides, for example.

The question of the time required for volunteers to train for their emergency service responsibilities is also relevant in the context of the potential amalgamation of the SES and the RFS. In recent times the investment of time needed to 'qualify' for operational membership of emergency organisations has increased markedly, and a national survey conducted in 2019 for the Australian Emergency Management Volunteer Forum found that these increases have had consequences that should be of concern. Amalgamation would almost unavoidably further increase the training time required, volunteers being pushed towards operating in both the fire and flood domains (as well as in other roles such as road crash rescue and storm damage mitigation).

Probably, recruitment would be discouraged and some existing members of the SES would resign under the additional demands imposed upon them. The consequences that would result if this became the case on any significant scale are not difficult to imagine. Indeed, the very effectiveness of flood management at the local level might be imperilled.

Mergers, it is clear, are likely to create substantial unintended negative consequences and in any case it is known that they are difficult to bring about. The experience of the ill-fated 1970s merger of the SES and the Bush Fire Brigades noted above is instructive, and the same is true of the several attempts (at least three since the mid-1970s) to amalgamate the two NSW fire-fighting organisations. None of these attempts achieved its goal. Nor have efforts to encourage the Volunteer Rescue Association (VRA) to join the SES been successful.

Amalgamation of the SES and the RFS would inevitably shake out membership from the SES. A loss of flood management experience and expertise would result, a thoroughly undesirable outcome. Reform of the SES's practises should be sought, not a merger of the organisation with another agency.

Fire and Rescue Assuming the Flood Management Role

The case for Fire and Rescue NSW acquiring the lead role in flood management appears to be based largely on the notion that 'professional' management (that is, management by people who are paid to perform it) is inherently superior to 'volunteer' management undertaken by people who are not remunerated financially for their time and endeavour. This position can be seen as insulting to the SES volunteer effort which has lasted for several decades: the volunteers regard themselves as having 'professional' standards of performance, to which they are highly trained, and they see this as being completely unrelated to the question of remuneration.

Yet a witness at the Select Committee's hearings, the State Secretary of the Fire Brigade Employees' Union, recently claimed that volunteer management by an agency that "looks after these events [floods] once a year, once every couple of years", looks like "madness". Fire and Rescue, he argued, is more experienced in incident management, is better trained in its application and does it routinely on a day-to-day basis.

This witness appeared not to recognise that SES members are also trained and highly motivated and many are involved in preparatory and operational activity for many hours each week: they do not merely 'show up' for duty when a flood threatens. What is important here is culture and experience, in which the SES and Fire and Rescue are far apart. The employees of the fire service, for example, have a more limited notion of and less experience with 'intelligence' as defined in the previous section of this submission. This has often been noted by independent, non-SES staff in Incident Management Centres during flood response operations.

Again it is difficult to see what would be improved by the SES ceding the flood management leadership role to Fire and Rescue. By comparison it is easy to see what would be lost: SES members possibly in large numbers would be likely to leave the service along with their accrued management and field experience. Furthermore, the cost in salaries in replacing what had been lost would be enormous for no guaranteed improvement in performance. There might be 'madness', indeed, in making such a change without very careful thought about the design of the change itself and of the potential for unintended consequences to arise.

Better, in this context, to focus directly on what has gone wrong in recent flood management endeavours and to rectify errors within the existing management structures. Some of these deficiencies were identified in the previous section of this submission and, as noted there, should be dealt with within the SES. The SES needs to rebuild its flood management culture to previous, lately somewhat eroded, standards, particularly in relation to preparedness functions. The organisation's role does not need to be taken over by another agency or reduced to providing "surge support" to that organisation when the job becomes large. Simply to reorganise agency roles administratively would be metaphorically akin to rearranging the deckchairs on the Titanic.

The existing arrangements have not to date been demonstrated to be deficient; rather it is practice in challenging management environments which has at times been flawed and which needs to be improved. That being so, radically reforming agency responsibilities only would be a risky strategy.

SES Operational Boundaries

One final matter of a management-related nature which impinges on operational effectiveness must be addressed. It relates to the geographical structure of the SES's regions below the state level. When the agency was created, its regions were delineated on river valleys or combinations of them. Thus the Richmond-Tweed Region covered the catchment areas of the two rivers of those names (and the Brunswick River between them) and managed the floods on them and their tributaries. There was also a North West Region which was responsible for the 'border rivers' (the Macintyre River and its tributaries within NSW) along with the area drained by and flooded from the Gwydir River and its tributary streams.

This was a sensible basis from which to operate as a flood management organisation. The number of rivers in a Region, and the scale of the problems which might be expected when floods occurred, were considered to be the prime determinants of 'manageability' in terms of workloads at the regional level and the ability of managers to come to grips with the SES's flood preparatory responsibilities.

In recent times this geographically-defined system of regions was abandoned and the 17 regions were collapsed into five zones for operational purposes. Necessarily these zones were very large, and their headquarters were in many cases located much further from the 'theatres of war' in which floods occur than had been the case under the regional model. The headquarters of the Northern Zone, which included Lismore, Murwillumbah and several other communities badly hit in the recent floods, was in Maitland. For the Commander of this Zone, which covered the area east of the Great Dividing Range from Gosford to the Queensland border, the span of control in terms of area and population to be managed was huge as was the task of getting to understand the strengths, weaknesses and capabilities of the nearly 60 local units.

Moreover the Zone Headquarters was almost bound to be considered by unit volunteers in the Northern Rivers, for example, as 'remote'. This was not simply in the context of physical distance.

This Zone as an entity was unreasonably large and it would be completely untenable in an operational sense if there were significant floods simultaneously on most of the river systems the Zone Commander was required to oversee and manage. Support from the regional level to local units would be endangered.

It can be argued, in fact, that the delineation of the five SES operational Zones as they existed at the time of this year's floods offended against one of the core principles of the Australasian Interagency Incident Management System (AIIMS). This principle relates to the 'span of operational control' which arguably became impossibly large under the zone system adopted. In my view the zone structure that existed at the time of this year's floods was seriously flawed and dangerously far from being fit for purpose.

An alteration to the structure was made in a government funding announcement on 13 June 2022, the number of zones being increased to seven with the former Northern Zone and one other being split into two. But this change addresses the span of control matter only in relation to two of the previously-existing five zones. The problem is still far from being solved.

Further consideration of what constitutes a reasonable operational span of control is necessary. The regional structure that existed before the zones were created was appropriate to the management of floods and generally worked well. Reversion to that structure (or something very like it) would be well advised and would produce benefits in operational terms.

Re-evaluating Land Use Management Standards

We should not lose sight of the fact that floods are a problem in Australia largely because of the way we occupy land. Building towns and cities partly or wholly on floodplains was not inappropriate in the nineteenth century, when rivers were not only transport arteries but also sources of water and drains for the disposal of industrial and human wastes. The continued growth into the twenty-first century of towns and cities located on floodplains, however, has produced an escalation of the flood problem in terms of monetary and other costs. Moreover, climate change appears to be exacerbating the costs of flooding further because of the intensification of rain events based on the well-established fact that a warmer atmosphere can hold more moisture to be triggered when relevant rain-generating weather systems (for example east coast low pressure systems and cold fronts) develop. The root causes of flooding, and the capacity for problems to be exacerbated by a warming atmosphere, need to be understood and addressed.

This means many things, among them dealing with the question of the human role in generating climate change. This, of course, requires global action: it cannot be much influenced by NSW alone. The state must be involved nevertheless. Equally, it is apparent that we should re-evaluate our land use management practices, and in this context the state can have a considerable influence at least within its own territory.

The recognition that extreme floods such as the ones experienced in the Northern Rivers in February and early March are likely to become more frequent is upon us and is now widely accepted in scientific circles. Indeed, an Australian authority (Pittock, 2012) has concluded that big floods will become bigger and more frequent in the forecast warmer future while small ones will occur less often. Meanwhile droughts are predicted to become longer and more severe. The extremes of both wet and dry are thus likely to become amplified.

If this is to be so as far as floods are concerned, what is now taken to be the 1% AEP flood will have an increased Annual Exceedence Probability as will even larger events. Very severe and extreme floods, in other words, are likely to be experienced increasingly often over the long term even though the change will develop only very slowly in terms of the human life span.

We must focus on the need to examine the ways in which we utilise floodplains. At the same time, it is important that we recognise that it is politically impossible to completely sterilise floodplain land from all development. Despite that impossibility, not-inconsiderable reductions in the effects of vulnerability to flooding should be achievable.

The extreme flooding experienced in the Northern Rivers earlier this year, coupled with the increasing recognition of the importance of climate change as a causative element, has created a significant moment. In this moment we must consider approaches which have hitherto not been taken up or have been utilised to only limited extents.

Past Approaches to Development on Floodplains

For many years, especially since the 1970s, New South Wales has attempted to restrict urban development on floodplains. Primarily, in terms of residential property, the state has done this by regulating the floor levels of new dwellings. There have been many changes to the details of the regulations over the years, but we are now at the point at which the floors of new dwellings must be set no lower than the level of the assessed 1% AEP flood plus 50 centimetres freeboard mainly to counter the effects of errors in the assessment of 1% levels. This means that, at the cost of the partial sterilisation of the lower parts of floodplains from development, houses on floodplains will not be flooded over their floors in frequent, relatively small and non-extreme floods. A benefit has clearly been achieved as a result of the regulations adopted over recent decades.

The adopted standard, however, is far from providing guarantees against inundation in bigger, less frequent flood events which virtually by definition are the most severe ones in terms of impacts. Moreover the standard ignores the fact that an equal level of protection between differing environments is not provided. This is because of the great differences between locations in terms of the potential vertical (and therefore horizontal) reach of floods in events beyond 1% AEP levels. For example at Windsor, on the Hawkesbury River, the difference between the 1% level and the level which would be reached by the Probable Maximum Flood (the PMF, an estimate of the highest flood possible) is of the order of nine metres whereas at Bourke (on the Darling River) and Forbes (on the Lachlan) it might be only about 0.5-1 metre.

In these different environments the flood-holding capacities of the floodplains are very different and the potential vertical rise of floods accordingly varies greatly. Flood vulnerability in rare but nevertheless inevitable big floods (defined here as floods beyond the reach of the respective 1% AEP flood levels) is thus in reality much greater in the Windsor area than in the other centres cited. Thanks to rapid and large-scale residential development in recent times in the valleys of the Hawkesbury and Nepean rivers (especially along South and Eastern creeks at Riverstone, Marsden Park and Marsden Park North), the numbers of people living on land which would be exposed to extreme floods up to PMF levels is now very large – indeed more than 120,000 and still increasing rapidly according to Infrastructure NSW (2017). This number is expected by the same agency to double by 2050. The consequences of a flood of similar proportions to the event of 1867 in the Hawkesbury-Nepean today would be calamitous and under present trends it will only become more so.

Towards Improved Approaches

One way of dealing with the inequality identified here would be to return to a previous approach to managing new residential development in flood-liaable areas in NSW. For some years before 2007 the standard was governed by the so-called ‘merits approach’ whereby the level at which floors could be set was determined not by a statistically-derived level (such as the 1% AEP level) but by risk as assessed ‘on the merits’ of individual cases and considering social, economic, ecological and cultural criteria, potential flood damage and the threat to life. Going back to the former standard would include allowing decisions to be made regarding floods reaching levels between the 1% AEP level and the level likely to be reached by the PMF. At Windsor and in many other areas east of the Great Dividing Range, some land would necessarily be lost to residential development if this change were

instituted. A more 'flood-defensive' approach to development would be promoted, however, and the degree of protection provided to dwellings would be increased.

There would, for these considerable gains, be some loss in terms of the abandonment of the extreme simplicity provided by the statistical, probability-based measure. Care would be required in defining the 'merits' being evaluated.

Naturally, there would be political difficulties associated with the changed approach recommended here being instituted. Technical staff in councils would oppose it for reasons of on the grounds of complexity. For another thing, developers who have banked large amounts of land in the expectation that development would be permitted according to current regulations would be disadvantaged. Such consequences can be said to occur, of course, whenever society's rules are altered, and rules in many fields are changed from time to time when a net social benefit can be discerned despite the fact that some individual or community interests might be negatively affected. That said, social benefit can clearly be demonstrated at the individual and community levels when the exposure of residential (or other) development to flooding is reduced. Moreover, this approach would slow the continual increase in the number of residential properties exposed to floods and limit future demands (for example, for flood-affected dwellings to be bought from their owners by the state after a severe flood) to deal with the problem.

In all this it should be noted that in some overseas jurisdictions, notably the Netherlands and parts of the United States, land use regulations have moved beyond the 1% AEP (100-year) standard that has been a kind of *de facto* standard in much of the western world for some decades. In the Netherlands the accepted standard for floor levels for new dwellings is the estimated 1250-year flood event. The standard there is not risk-based, but it is high.

Another approach would be to increase the availability of 'buy-back' funding for dwellings likely to be flooded, whereby the state purchases properties at market price, demolishes the buildings on them and offers affected individuals flood-free sites elsewhere and preferably nearby. In the valley of the Hawkesbury-Nepean River and its tributaries, for example, there are about 5000 dwellings whose floors were built at below the 1% AEP level. These dwellings were constructed before the current regulatory regime was introduced.

There is an unknown (but nevertheless considerable) number of such dwellings in North Lismore, South Lismore and the CBD of Lismore and in smaller downstream towns including Coraki, Woodburn, Broadwater and Wardell. All these areas were disastrously flooded earlier this year.

Buy-backs are very expensive, of course, which in part explains why they are not frequently utilised. But it is also the case that the pool of public money available to buy-back (and indeed house-raising) schemes is small: a substantially greater impact could be achieved if such schemes were made more generous so that more homeowners could benefit from them. A significant dent could potentially then be made in the size of the problem of the number of dwellings on floodplains. With funding at current levels, the problem can only be reduced at the margins. More ambition is needed here.

It might also be considered appropriate, as a means of increasing the frequency of property buy-backs, to make buy-back purchases and land swaps compulsory rather than, as is the case at present, voluntary – at least in the case of properties which are subjected to

inundation in events occurring more frequently in an area than the 1% AEP flood. Making this change would be akin to following the approach used for new transport infrastructure in cities or for properties in locations that will be flooded when water-storage dams are constructed. In such cases compulsory relocation is necessarily mandated. Hundreds of houses were lost to the construction of the approaches to the Sydney Harbour Bridge nearly a century ago and many dwellings had to be abandoned when the dams of the Snowy Mountains Scheme drowned the sites of the towns of Jindabyne and Adaminaby. The construction of Warragamba Dam to create Lake Burragorang, which provides the vast bulk of Sydney's water, had a similar consequence: farms, dwellings, holiday homes, guesthouses, camping areas, schools and churches had to be vacated, purchased by the state at considerable cost and all buildings demolished (Aird, 1961, p110).

Beyond these matters, there is also a need to ensure that flood mitigation initiatives are not undermined by developmental decisions. The 'levee paradox', whereby intensified development is encouraged by the construction of levees which are designed to keep out only frequent small and middle-sized floods, has been demonstrated frequently in Australia (see, for example, Keys, 2020, pp143-44 and 292-93 in the case of Maitland). There, council resolutions in 2015 and 2017 to seek relaxations of building standards in areas behind levees (for the purpose of encouraging residential redevelopment there) were only negated by decisions made under ministerial discretion. A different minister might have ruled differently, which suggests that an examination of the robustness of the regulations is warranted.

It is possible, even probable, that decades after a levee has been built (and when it has kept floods out for the entirety of its existence), complacency about the risk of flooding will lead a council to unwise developmental decisions. These decisions, as the Maitland case suggests, will have the potential to increase the community's vulnerability to floods. No levee in NSW, it should be noted, is designed to exclude a flood of PMF proportions.

In effect the mitigative benefit of levees is reduced or lost when councils, confident that their levees have constrained the flood problem, permit more assets (houses, commercial and industrial uses, infrastructure) in the 'protected' areas behind them. Thus is 'extra' development exposed when large floods overtop the levees or cause their failure. In this context it should be noted that five town levees in New South Wales, at Nyngan, Kempsey, Lismore (three times, including twice this year), North Wagga Wagga and Murwillumbah, have been overtopped since 1990. There have in addition been several 'near misses' over the same period (for example at Grafton, on the Clarence River, Coonamble on the Castlereagh and Hay on the Murrumbidgee). Levees, clearly, do not provide full flood immunity as is often assumed by councillors and residents. They palliate the flood risk but cannot be expected to eliminate it.

The same paradox is in prospect when a dam is raised as an intended flood mitigation measure and further development is as a result encouraged on floodplains downstream. The experience of Brisbane after the completion of Wivenhoe Dam in the early 1980s is instructive here (Cook, 2018; 2019): residential and other development permitted in several suburbs downstream of the dam was badly flooded in both 2011 and 2022. In the first of those two floods, more dwellings were flooded over their floors than had been the case in the very severe flood of 1974 despite the fact that the 2011 event peaked at a somewhat lower level than had been reached in 1974.

Perhaps chillingly, in 2021 the then Minister for Emergency Services in NSW speculated on Sydney radio station Triple M that the state government's intended raising of Warragamba Dam might allow additional low-lying land to be released for development in the Hawkesbury-Nepean. This statement was made despite the fact that significant tributaries of the Hawkesbury River enter the river's main stem below the dam and can cause severe flooding by themselves. Stronger regulatory protections against the potential for the levee paradox (which also functions as a dam-raising paradox) to be evoked and demonstrated are needed: insufficient guarantees appear to exist at present.

Indeed, stronger regulatory processes are needed in general if the problems of the increasing costs of flooding are to be contained (or better still reduced). All the approaches noted here will be to a degree politically problematic as regards implementation, of course, and they would not be inexpensive to institute. But that is also true of maintaining the *status quo* which condemns families and society at large to the enormous economic and other costs of reacting over and over again to the deleterious effects of flooding. As things stand, we continue to commit the state and its people to increases in these costs as we have always done. A real contribution could be made by seizing the opportunities provided by this year's very severe floods on the North Coast of NSW by resolving to adopt stronger measures than the state has previously utilised. The alternative is to watch the costs rise still further as we continue to develop floodplains for urban purposes and as climate change slowly exacerbates the a known problem even further.

More defensive approaches to urban development on floodplains must therefore be considered essential. Especially this is necessary if we are to truly learn the lessons of the extreme flooding recently experienced on the northern rivers of NSW. In my view the time has come, now that the role of climate change in intensifying our flood problems has largely been accepted by science and in the Australian community, for rethinking public policy in relation to the utilisation of floodplains.

Not to take up the challenge that presents itself is likely one day to be considered as a failure of government in the 2020s.

Conclusion

As a matter of urgency, the SES should be required to reinstate its planning section, codify the section's roles and tackle the substantial backlog of planning work as far as reviews of local flood plans are concerned. Merging the organisation with another agency or transferring responsibilities from the SES is not recommended because it would not address the fundamental problems, but there is room for reconsidering the state's regulatory processes as far as residential development on floodplains is concerned. Buy-back, land swap and house-raising schemes could and should be funded on an expanded basis.

Not tackling the issue of land use will mean condemning New South Wales to continued, repeated and worsening economic and personal pain especially if, under climate change, severe flooding becomes more frequent as scientists currently predict.

This is a moment in time which the current generation must seize in the interests of promoting community resilience in NSW. Too frequently, post-flood studies in the past have been timid on this score and opportunities to make communities more resilient against the

flood threat have thus been missed or not taken up to optimal effect. In effect “the can has been kicked down the road”, and repeatedly. We must surely take stronger steps than we have taken in recent times to overcome the mistakes of the past in relation to land use on floodplains, and we must be prepared to resource the steps we take.

Some of these mistakes, unfortunately, are still being made, especially in areas like the Hawkesbury where large-scale suburban development is occurring at levels well below those which would be reached by floods of PMF proportions. A massive problem is being created for a future generation to confront when a very big flood — perhaps one not as big as 1867’s — strikes. Such a flood should be regarded as inevitable — one day. It could come soon, and it might not come for centuries. As things stand, its impacts will be dreadful.

Lismore’s flood in February, peaking more than two metres higher than the highest floods seen there previously in more than a century and a half of European settlement, was inevitable too as it was for the communities downstream. Very big floods on others of the state’s river systems are similarly inevitable at places like Murwillumbah, Grafton, Kempsey, Singleton, Maitland, Moree, Forbes, Wagga Wagga and many other centres as well as in the suburbs located on the floodplain of the Georges River in Sydney. Such floods happen every now and then and without doubt will continue to do so. This reality must be accepted, and public policy that seeks to facilitate the management of land that will be inundated by rare very large floods must reflect that acceptance.

Tools are available to help us do better than we have done hitherto and are still doing in flood management in its several guises. What is needed is the appropriate will to utilise the tools, backed by sufficient funding.

If it is deemed useful, I will be prepared to meet those conducting the Inquiry to discuss this submission. I consent to the submission being published on the Flood Inquiry’s website.

The Author of this Submission (Chas Keys MA (Hons) PhD ESM)

In my careers since 1990 I have developed expertise in flood response management, in planning to deal with the occurrence of floods, in comprehending the contexts in which flood mitigation decisions are undertaken and in coming to grips with the benefits and disadvantages of proposals for development on floodplains. Over many years I have liaised frequently with personnel from the Australian Government Bureau of Meteorology, the various water agencies (the New South Wales departments of Public Works and Water Resources and their successor organisations), the state’s Department of Planning under its various titles, councils of local government (involving councillors, technical services staff and planners), the Dams Safety Committee and the operators of storage dams, SES staff in State Headquarters and regional offices throughout NSW and many volunteers in local SES units. I also participated for a long period in the activities and deliberations, including annual conferences, of the Floodplain Management Authorities of NSW (now Floodplain Management Australia) and had many interactions in workshops with the staff of the Australian Emergency Management Institute at Mount Macedon, Victoria.

In these interactions I learned about flood forecasting and warning practices, the application of land use management regulations and the many aspects of flood preparation (such as organisational planning and community education) and real-time flood response activity

including warning development and delivery, evacuation management and the undertaking of resupply operations. Flood management is a complex activity with myriad dimensions.

While employed by the SES and afterwards as a consultant, I led in the development of a number of best-practice national flood management manuals on flood warning, flood preparedness, flood response and planning for releases from storage dams. These manuals, devised to help practitioners in various aspects of flood management come to grips with their roles, were published initially in 1995 and 1998. They were reviewed and updated by multi-state committees which I oversaw and led between 2007 and 2009 (Commonwealth of Australia, 2009a; 2009b; 2009c; 2009d).

I have also written three books about the New South Wales SES (Keys, 2005; 2006; 2008a), one on flood mitigation and floodplain management (Keys, 2008b) and two on the history, nature, management and politics of floods in Maitland, New South Wales (Keys, 2008c; 2020). My writing about flooding and flood management has ranged widely, dealing with the issues from many angles.

As a result of this activity, I believe I have come to understand deeply the strengths and weaknesses of flood management as it is practised in New South Wales and other parts of Australia. I have retained my interest in flood management issues throughout my retirement, written widely about them online and in newspapers and been sought out on many occasions by media organisations for comments on flood-related management matters.

A short paper of mine which was published on 10 March 2022 on John Menadue's 'Pearls and Irritations' website in the wake of the state's recent floods is appended after the References. This document represents a guide to what might be called 'the big picture' of flood management in Australia and provides background to my comments on the specific matters addressed in detail in the present submission.

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A Ten-Point Plan for Managing Flooding in Australia

All flood crises are more or less wasted, and the ones we have just experienced in New South Wales and Queensland will probably be no different.

What has occurred on Australia's east coast over the past two weeks leaves us with a 'learning moment' to determine what we can do to better manage floods in the future: this should be a strategy-forming opportunity. Sadly, we are unlikely to grasp it: we rarely have in the past and this time is not likely to change the situation fundamentally. Recovery co-ordinators will be appointed and reports written but the media, the political system and the community will move on and not much will happen. Next time severe flooding occurs, people will express the same surprise, disbelief and anger but we will do very little before we move on yet again.

Nevertheless there is no better time than the present for a big-picture examination of the problem. There follows a ten-point plan for Australia to deal with flooding. We already do some of what's recommended, but we rarely do enough of it and what we do falls away

after an initial burst of enthusiasm and public-sector investment. Some initiatives proposed below we have barely tried.

1 Recognise that flood management requires a multi-pronged approach. Our standard reaction is to see floods as enemies to be overcome, which leads us to seek to place most of our trust in 'regulating' floodwaters by building structures like levees, flood mitigation dams or flood bypasses. Instead we should recognise that we must learn to live with floods because they are inevitable and unconquerable, requiring us also to seek to modify communities and community behaviour as well as floodwaters. This involves education, and we should be looking at school curricula and at adult education for opportunities. Mitigation by way of structures has a role, but it cannot be the whole of the strategy. Levees, after all, are frequently overtopped: this has happened in seven urban centres in New South Wales alone since 1990. Several of the points that follow focus on community-modifying methods which will help people adapt to the inevitability of flooding.

2 Ensure that communities, householders, businesspeople and the operators of institutional premises in flood-liaible areas know how to plan for floods – and are motivated to do the planning. That means more flood-defensive land use planning (including zoning) on the part of councils, a deeper consideration of warning, rescue, evacuation, resupply and community engagement strategies by the emergency services (some of which plan for these things, but their planning documents are sometimes limited in scope and too often allowed to become dated). Planning can and must be done for events of unprecedented severity; in other words extremes must be foreseen. There must also be a recognition on the part of residents that planning (which simply involves thinking about what should be done when a flood threatens) is necessary. Household-based planning is rarely conducted, but it is easy to do when it is explained and it can contribute hugely to saving on losses when floods strike – because it identifies in advance what should be done (for example by way of property-protecting strategies including arranging to move items off-site). There is a need too to counter myths which are deeply embedded in the psyches of people in flood-liaible areas – the notion, for example, that levees have rendered floods harmless by keeping out all future flood events. They never can. Nor does councils allowing people to build in flood-liaible areas mean that such areas are not actually prone to flooding, yet many believe the opposite to be the case. Planning can be used to educate people on several fronts.

3 Educate people about flood warnings: this must be a major part of creating more informed communities. Our flood prediction and warning systems provide information on approaching floods, but only rarely do they communicate effectively to people in the path of such floods about what they can expect. Information is provided, but not teaching – so there is little learning. People are routinely surprised and complain that they weren't warned, or that the flood they have just experienced caused them more damage than an even bigger one in the recent past which left them relatively unscathed. To a degree they are right. There is scope here for regular provision of carefully-written information, letter-boxed periodically in flood-liaible areas, and information imparted in neighbourhood-level meetings. The information needs to explain flood dynamics in simple, comprehensible, non-technical terms. Meetings allow people to ask questions about flood management strategies

including the meaning of predictions and advice. Critically, a better understanding of warnings, and warnings being made more relevant to the level of the individual property (there is scope for more use and communication of flood animations, forwarded to people's mobile phones) will allow people to better plan, because it will help them to understand the need to act before they see the floodwater rather than delaying and thus squandering the benefits warning can provide.

4 Change the balance between spending on mitigation and spending on relief and recovery. The Productivity Commission's figures on public investment in relation to flooding are often quoted: it is estimated that 97% of the public spending as a result of flooding is on relief and recovery against only 3% on mitigation. Queensland, in particular, has been dilatory in its investment in town-protecting levees, although the 2011 floods produced a brief flurry of levee construction. New South Wales has done better over many decades, but a backlog of mitigation projects awaits funding there too.

5 Ensure that our institutions pull in the same direction. We cannot continue to have local councils, influenced by development interests, talking down the flood threat and promoting development in severely flood-labile locations – and then expect insurance companies to 'bale out' the consequences. This leads to unaffordable premiums, which means people with assets in flood-prone areas being unable to insure their dwellings and contents adequately. It also leads to rises in insurance premiums generally. Likewise we must ensure that mitigation efforts do not lead to the so-called 'levee paradox' in which building a levee (or raising a dam) promotes an intensification of land use in the 'protected' areas: when the levee is overtopped (or the dam's capacity is exceeded), there is thus more to be lost and in addition more lives are placed at risk. A potential example can be seen currently in New South Wales where some Cabinet ministers advocate the raising of Warragamba Dam to pond floodwater and thus mitigate downstream flooding – but this proposal has led to the suggestion from within the same Cabinet that raising the dam could legitimately be used to justify releasing more low-lying floodplain land for housing on a mass scale. Such contradictory thinking leads to wasteful, inefficient, vulnerability-enhancing development in which mitigation initiatives are undermined from within.

6 Manage land use on floodplains more effectively. In recent decades the trend has been for residential floors to be permitted only above the 1% Annual Exceedance Probability (AEP) (so-called one-in-100-years) flood level, but this standard is less effective than might be supposed: floods exceeding the standard often occur as at Lismore recently. A better approach is to use risk as the fundamental criterion rather than a statistically-derived, abstract flood level, and to be more conservative in decision making than is usually the norm under the current numerically-based approach. For example, we should err on the side of caution when considering the likely impacts of flooding above currently defined flood planning levels and be prepared to reject development at higher levels than at present. This will help contain the steady drip, drip, drip of development on floodplains which stealthily, almost imperceptibly, increases community vulnerability.

7 Be more vigorous in promoting buybacks of the most severely at-risk properties. In the valley of Sydney's Hawkesbury-Nepean river system there are an estimated 5000 dwellings

whose floors are below the 1% AEP flood level (and the number of like dwellings in the valley of the Georges River is probably even higher). This is the legacy of past development from the decades before the adoption of current floor-level standards. Voluntary buybacks, paying market value to owners followed by the physical removal of the houses, have been available in some areas for many years but too few people have taken them up. A stronger commitment to convincing property-owners, perhaps involving additional incentives, is needed.

8 Stop using inadequate, misleading language to describe floods. The term 'one-in-100-years' flood is now used in the media and the community to describe any serious flood: it has become unhinged from its originally intended meaning. Properly used, it should refer to *average* recurrence intervals rather than, as often occurs in receptors' minds, to the length of time that will elapse before the next flood of similar proportions. Some people believe that having recently experienced a described 100-year flood they will be immune from another for the rest of their lives. Using even larger numbers (for example, the 'one-in-1000 years' flood), as some commentators have done in reference to the recent floods on the New South Wales North Coast, simply raises disbelief and cynicism and derails community discourse. Poorly-used terms discourage understanding.

9 When building on floodplains cannot be avoided, ensure that the building is done in a way that is compatible with floods. This means using appropriate building materials (not plasterboards, chipboards and plywood bracing which cannot withstand immersion) and banning concrete slabs. And when we replace flood-damaged infrastructure such as roads, we must use the 'build back better' principle rather than simply replacing to the previous standard what was damaged so that it will be damaged again in a similar-sized flood. Recovery should seek improved standards, not more of what existed before.

10 And most important of all, take climate change seriously by cutting back drastically on the mining and burning of fossil fuels. Most nations have been dilatory on this, Australia more than many others despite the fact that our per capita emissions of carbon dioxide are amongst the highest in the world. It is well known that a warming atmosphere, now comprehensively proven and accurately measured, can hold more water vapour to be released as flood-producing rains. Equally it is known that sea level is rising, making coastal flooding and erosion from storm surges more problematic. The likelihood is that severe floods are already occurring more frequently than they did a few decades ago, and further atmospheric warming and sea level rises can only exacerbate the situation. As a nation we are creating more than our share of the global problem and should be contributing more to the solution than we do.

There is no more manageable agent of natural hazard in Australia than flooding: we know where it will occur, we usually get warning of it and we can predict what its effects will be. But we never manage it well. It hurts us repeatedly and to a greater extent than it should.

From **Pearls and Irritations**, John Menadue's Public Policy Journal, 10 March 2022

