Institute of Actuaries of Australia

Submission to

Queensland State Government

Queensland Floods Commission of Inquiry

4 April 2011

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1. Executive Summary

Queensland has significant exposure to flooding and other natural disasters. Loss of life can be devastating, and loss of assets financially calamitous.

Estimations of the frequency and severity of floods or the footprint for a given event are subject to significant uncertainty. There are many properties that have experienced flooding before and will be flooded again at some point. Mitigation actions are needed to effectively manage this flood risk, as well as the implementation of incentives and structures to appropriately allocate post-event recovery costs.

As demonstrated by the recent flood events, many Australians may underestimate or not be aware of the degree of flood risk to which they are exposed. Without clear signals to encourage more active engagement by the public, this will continue and the economic hardship witnessed in the recent events will occur again.

Summary of Key Points

Flood management and mitigation

Flood management and mitigation are crucial components of any action to minimise the impact of floods and other disasters. Land use guidelines in Australia need to be considered with a frank and transparent assessment of exposure to natural hazards. There is existing development and infrastructure in flood prone areas where mitigation measures can be implemented. Future development of major infrastructure and buildings should occur away from flood prone areas. Inappropriate planning and development and inadequate risk mitigation may have contributed to the recent floods resulting in more damage than the bigger floods of 1974 in Brisbane.

Mitigation measures will not alleviate all exposure to flood, but will likely have long term benefits. It is difficult to measure the positive financial impact of appropriate mitigation measures, but it appears that long term significant savings are achievable which exceed short term costs of mitigation.

Funding structures can create moral hazard by failing to create sufficient incentives for risk mitigation, loss limiting or direct reduction of losses. Co-insurance and other mechanisms such as partial or capped loss funding can create an incentive for individuals and organisations to manage and reduce risk.

The interplay of public sector funding and disaster response and the insurance market needs to be considered in the design of any scheme

Recommendation (refer Sections 4 and 8)

The Institute recommends that the Commission formally considers ways to reduce risks to existing assets as well as limiting growth in exposure.

Care must be taken to avoid proposals that will ultimately increase the costs of flooding to the community through encouraging inappropriate behaviours amongst affected groups. For example, ensuring that proposals will not continue to encourage building houses in areas of high flood risk to standards that are not resilient to flood.

Insurance may become unaffordable

If insurance is priced according to risk, premiums in flood prone areas can be very high, possibly unaffordable to many. Without compulsion to take out insurance cover and either government subsidies or community rating, the present situation of some degree of under-insurance, with the expectation of some form of post government bail out, will continue.

Recommendation (refer Sections 5 and 12)

The Institute recommends that the Commission's conclusions recognise the very local aspects of flood risk and the fact that, without some form of regulation or intervention, private market competitive mechanisms will result in the cost burden being isolated to the areas identified as being at-risk and therefore protection being either unaffordable or unavailable in these areas.

Funding for flood losses via legislative or other means needs to have specific goals reflecting who should benefit and the level of benefit provided whilst not discouraging mitigation of risk.

Responsibility for flood losses should be transparent

To the extent possible, prior to any event, clarity is required as to how future losses will be shared among property owners, Local, State and Federal governments.

Recommendation (refer Section 11)

The Institute recommends that the Commission consider funding solutions that make flood loss funding transparent and shares costs across the community in a way that encourages effective risk management.

Sharing the costs of floods

Potential options for funding flood costs include accessing pooling mechanisms. This may involve some degree of cost being borne by those who are not directly impacted by flooding. When a large number of properties are not exposed to the risk of flood, a relatively small contribution from the owners of those properties can aggregate to a sufficient sum to cover the significant costs expected in the exposed areas. For these pooling structures to be effective, some government action will be required (examples where this currently applies include CTP and health insurance where community rating applies). There is a trade-off between equity and affordability when considering pooling structures.

Recommendation (refer Section 7)

Care must be taken to avoid funding solutions that will lead to the most vulnerable sections of society being unprotected.

To effectively subsidise flood costs, it may be necessary to draw in the widest possible range of participants, including those at minimal or no risk of flooding, to help fund the costs of mitigation and flood losses.

Pre- or post-event funding of losses

Losses from flood and other natural disasters can be funded on an ongoing basis or after any event. There are advantages and disadvantages of both approaches. We set out in section 10.1 of this submission some overseas examples of national flood schemes. In almost all examples, some form of government intervention applies.

Catastrophe bonds may be an effective funding mechanism for natural disasters. This includes the possibility of government-issued catastrophe bonds.

Funding floods and national disasters is at the same time a local, state and national government issue, and any approach needs to balance risk sharing and management with economic affordability and generational equity at each level.

Recommendation (refer Section 10)

The Institute recommends that the Commission note.

- **the Federal government may be considering a nationwide response to disaster mitigation and funding,**
- **that both public and private funding have a role to play in funding flood losses, and**
- **overseas examples exist that may be useful to draw from.**

Flood modelling is limited

Flood models and related data are useful tools but better models, readily available data and common flood definitions will not provide a solution in themselves.

The long term financial viability of funding schemes for natural disasters is ultimately dependent on creating behaviours or requirements to mitigate or limit future losses. This is exacerbated by the inherent unpredictability of flood frequency and occurrence. Potential exposure to flooding is estimated using scanty data and models that will never be able to reflect all the intricacies of real world processes. Mitigation and funding solutions should be designed with potential floods in mind which exceed floods seen in historical records.

Recommendation (refer section 6)

The Institute recommends that

- **the Commission formally recognise the uncertainties involved in predicting flood risk and losses, and the associated problems that are created for funding by these uncertainties and**
- **the Commission recognises that flood models are useful tools but better models and data will not provide a solution in themselves.**

2. Background

The Institute is the sole professional body for actuaries in Australia, providing expert and ethical comment on public policy issues wherever there is uncertainty of future financial outcomes. It represents the interests of over 3,800 members, including more than 2,000 actuaries. It is the public face of a learned profession, which primary focus is on the evaluation of risk and opportunity. Our members have had significant involvement in the development of government policy and regulation, financial reporting, risk management and related practices in Australia over many years.

Our contribution to public policy development is guided by the public interest, the principles of transparency, 'the equal playing field' and good regulation.

Following the devastating floods across Queensland during December 2010 and January 2011, the Queensland State Government announced a Commission of Inquiry (the Inquiry) into all aspects of the flood disaster. The Inquiry is intended to cover aspects ranging from disaster management and response through to post event recovery and rehabilitation including public as well as private infrastructure and assets and the tragic loss of life.

Submissions to the Inquiry have been invited from the public on any aspect to be covered by the terms of the Inquiry. This submission from the Institute of Actuaries of Australia intends to focus primarily on matters relating to the cost of flood disasters and mechanisms that can be employed to fund the recovery and rebuilding efforts following those disasters.

Specifically, this submission is relevant to the following sections of the Inquiry Terms of Reference:

a) the preparation and planning by Federal, State and Local governments; emergency services and the community for the 2010/2011 floods in Queensland;
b) the performance of private insurers in meeting their claims responsibilities;
c) all aspects of the response to the 2010/2011 flood events, particularly measures taken to inform the community and measures to protect life and private and public property, including

- immediate management, response and recovery,

and

g. all aspects of land use planning through local and regional planning systems to minimise infrastructure and property impacts from floods,

Whilst formally being submitted to the Inquiry, the topics covered in this submission are not limited specifically to flood risk in Queensland. Many of the issues discussed herein relating to flood are also relevant for other natural disasters. Flood risk and other natural disaster exposure exist in every state and territory of Australia and therefore the issues discussed herein are relevant to the whole population. Many of the potential solutions, in particular those involving explicit risk sharing agreements between property owners, State and Federal governments are more powerful with larger pools of risk.

3. Flood Damage and Costs Incurred

Damage arising from flood water ranges from superficial (such as muddied park furniture) to total destruction. The degree of damage inflicted by flood water depends on the depth and velocity of the water and the duration of inundation. All of these aspects are unique to each flood and will vary along the waterway according to local topographic features and the pattern of rainfall.

A wide range of assets can be damaged in floods including:

- Public Infrastructure (roads, sewage and other key infrastructure),
- Public Assets (government buildings, etc),
- Private Assets – Commercial (shops, plant and equipment, stock, crop loss, farm damage, etc),
- Private Assets – Domestic/Personal (cars, home buildings, home contents, boats, personal possessions, etc.).

In addition to direct costs in terms of asset damage, indirect costs also arise from floods including:

- Loss of profits and other economic loss through business interruption,
- Loss of personal income (wages) and unemployment,
- Workers' compensation claims and other injury losses incurred during both the flood event itself and the recovery activity.

The cost of the damage lies in loss of life and other losses. Many of the losses can be measured in terms of loss of value or cost to replace or repair the affected asset, and loss of earnings. It is not always appropriate to use the same measurement process for different assets, as the true cost depends on the extent to which it is necessary to rehabilitate or replace the damaged assets.

For example, farm land on the outer curve of a river bend may be washed away, thereby incurring a loss to the land owner. However, it is not economical to replace the washed away land. In such a case the 'cost' may be measured in terms of the proportion of the asset lost based on the pre-event value.

Replacing a building or piece of infrastructure may cost more than the value of the original asset. It will also almost inevitably cost more to replace than it originally cost to build as a result of inflation as well as changes to building standards.

An alternative measure of cost for assets covered by insurance is the insured value of the damaged asset. Under-insurance means that in many cases (especially home insurance) the premises will be insured for less than the cost to rebuild, and contents may be insured for less than the amount required to replace all items. It is then the choice of the insured to either reinstate their assets (with some own contribution in addition to the money available from insurance) or simply rebuild or replace to the amount afforded by the insurance cover.

A final loss of value caused by floods is found in the changes to property values (reductions) that follow the public realisation that a particular location is prone to flood.

This value destruction is very difficult to quantify and usually not apparent until some period after the flood event.

As well as the direct costs of flooding in terms of damage, subsequent economic costs are also incurred through business interruption, unemployment and drop in consumer confidence.

It should also be remembered that the cost of flooding for a given area will change over time as areas are developed. This is because the development of one area can impact the flood risk for another, such as when previously open fields are built over, changing water flow patterns.

The total cost of flooding is therefore prone to mis-statement, both in estimating the cost of future events and losses from events that have occurred. Estimates of actual or potential losses, need to have clear definitions of the basis of calculation. When considering the issue of funding the recovery from a flood event, it is therefore necessary to define what exactly is to be funded so that appropriate costs can be considered in the funding planning.

Importantly, it should be understood that the reported costs of floods are typically significantly less than the true total cost.

3. Recommendation

The Institute recommends that the Commission consider all aspects of the costs associated with flooding during the course of the Inquiry. Any recommendations need a clear definition on what costs will, and won't be addressed.

4. The Importance of Sound Funding Principles in Building Community Resilience

A sound funding basis for the costs of recovery from flooding and other natural disasters will limit the economic consequences of the damage inflicted by making funds available for reconstruction quickly after the event. A sound funding basis also assists in managing uncertainty for impacted parties.

Whilst the recovery action itself may have the effect of immediately providing economic stimulation, delay in recovery (such as that caused when funding is not available) will have negative impacts on the local economies directly affected by flooding. The negative economic impacts in turn have negative social aspects such as unemployment and depression.

Without a sound funding source, funds for disaster recovery will be diverted from their original purpose. The original targets of the funding either receive funding later (eg next budget cycle) or not at all. The resulting re-allocation of resources within the economy can cause frictional impacts where certain sectors experience a boom whilst others go through a period of reduced activity as a result of the reduction in funding.

Funding mechanisms which only allow for partial recovery will also have long term implications for affected communities.

Funding mechanisms need to avoid discouraging mitigation efforts which we discuss in Section 8 of our submission.

As well as providing a mechanism for re-establishing the economic fabric of an affected community, funding can be structured to provide incentives to rebuild in a way that reduces or limits exposure to future losses. This will mean that future events will have less impact on the community. Such incentives can include direct 'conditions' or building standards. This is discussed in more detail later in this document.

4. Recommendation

The Institute recommends that The Commission focus on legislative changes that will support funding mechanisms that improve community resilience to future events whilst not discouraging mitigation of risk.

5. Comparison of Funding Goals

Whenever funding is considered, be it via insurance, self-funding, handouts, government funds or other means, it is important to establish goals or outcomes that the funding structure is intended to facilitate. These goals can include the degree of reinstatement or type of restoration, importance of mitigating or reducing future losses, ensuring that funding is directed to the intended recipients and the consequent outcomes for third parties.

5.1 Type of Restoration

The restoration or replacement of damaged assets and infrastructure can have any of the following goals:

- Do not replace or repair – this includes the option of moving dwellings and infrastructure away from flood prone areas
- Partial replacement or repair (eg. up to $X),
- Reinstate to original condition,
- Replace to a new standard intended to reduce future risks however potentially at significantly greater cost,
- Economic losses (loss of earnings etc).

Different restoration goals can apply for different types of assets and asset ownership within the same funding scheme.

5.2 Role in reducing future losses

The long term financial viability of funding schemes for natural disasters is ultimately dependent on creating behaviours or requirements to mitigate or limit future losses. Funding can be structured with this objective in mind.

Imposing conditions for the distribution of funds can help reduce exposure to future events. For example, minimum floor heights and the types of construction materials can be mandated.

Not allowing rebuilding in some areas will lead to a reduction of future losses.

5.3 Funding Target Groups

Any government sponsored funding program should have clear goals relating to who should benefit and to what level (i.e. full, partial, etc). Eligibility for funding can be defined through mechanisms such as means testing, explicit categorisation (eg. commercial or residential) or other methods of delineation.

The interaction between government and private funding (via insurance) needs to be considered. If the government targets post-event funding to those without insurance, there is a risk of discouraging private funding of potential losses. If post-event funding is dispersed indiscriminately, there is a risk of over-compensation for some.
The availability and affordability of alternate forms of protection (such as private insurance) will also influence the definition of the target groups. Equitable, or fair,

outcomes will not be possible if groups are forced to use alternative forms of funding that are simply not affordable. This is discussed in more detail in section 9.

5.4 Third Party Interest in Restoration

Where funding solutions include target groups that may have assets where third party interests exist (such a loan encumbrances), consideration needs to be given to the needs of those third parties, particularly where restoration funding may only allow partial rehabilitation or recovery of the encumbered asset.

The presence of third party interests can be a useful delineator when considering the target groups. Such assets may be required by the third party to have particular types of private insurance cover as a condition of a financial contract related to the asset.

There often exist additional layers of interested parties behind the immediate third party. For example, banks lending funds with property as security often require Lenders' Mortgage Insurance (LMI) cover for situations where the loan cannot be repaid and the underlying asset's value can not be realised for an amount sufficient to cover the outstanding loan. LMI insurers can often end up with a significant portion of losses arising from events which impact both ability to repay loans and value of underlying assets.

Each of these third parties may wish to be involved in the design of a funding structure to ensure that the appropriate behaviours are encouraged and financial outcomes do not have unintended second and third order impacts.

5. Recommendation

Funding for flood losses via legislative or other means needs to have specific goals reflecting who should benefit and the level of benefit provided whilst not discouraging mitigation of risk.

6. Expected Losses

6.1 Introduction to Estimation of Expected Costs

The extent to which a property is exposed to the risk of flood (or any natural hazard exposure) is frequently referred to in terms of an expected or average loss. This comprises the likelihood of having an incident in a given period (usually a year) and the average size of any incident that does occur.

A continuum of possible event magnitudes exists, where more extreme events are expected to occur less often. For a given magnitude, the likelihood of occurrence in a given period is usually described as the 'return period' or 'ARI' (average recurrence interval). For example, a 1-in-100 year ARI equates to a 1% chance of occurring in a 12 month period.

Within a selected period the risk of occurrence may not be uniform. For example, over a 12 month period it is more likely for floods to occur during a 'wet season' than during a 'dry season'.

Any single point estimation for expected losses does not reflect the volatility of actual outcomes, and no estimation model can reflect the variability of real world processes. Any funding model needs to recognise that there will be periods of no loss and then, when there is a loss, wide ranges of possible loss size. Also, past losses are not an infallible indicator of future losses, particularly in Australia, where historical records are limited.

6.2 Uncertainty in Estimation

It is important to understand the uncertainty involved in determining the underlying distributions necessary to produce the expected losses. The primary sources of uncertainty include:

6.2.1 Modelling Error

Several models are necessary to estimate flood losses. This includes a meteorological model (how often rain events of different magnitude can occur) and a hydrological model (how the water will flow once it hits the ground).

These complex models are designed to predict losses arising from intricate and unpredictable processes. The models are inevitably simplifications of the real world and as such the actual flows and resulting water heights from a given quantity and location of rainfall are likely to be different to the results of the models.

The models are also impacted by any change in climate over time; it is clear that both short and long term global climate trends can impact local weather patterns.

6.2.2 Parameter Estimation Error

Any model requires assumptions or parameters to produce its outputs. These parameters are usually obtained through observation of past events. The observation of past events is subject to observation error as well as limited by the size of the window of observations. In Australia, many natural hazards have been consistently observed for a relatively short period of time, often not longer than 50 years.

When very remote events are being modelled, such as a 1 in 1000 year flood, it is necessary to remember that assumptions are being extrapolated to time periods much longer than the period of observation. If the period of observation is not 'average' (for example drier than the long term average) this can bias the parameter estimation process resulting in a significant under (or over) estimation of the magnitude and impact of an event.

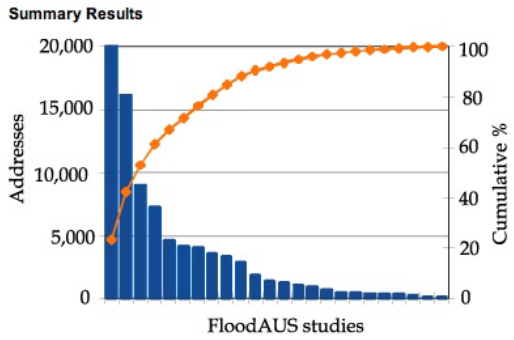
6.3 Residential Exposure

The table below summarises estimates of the number of residential dwellings in Australia and by state 'at risk' of inundation (partial or full) at various return periods. (It is important to remember that these estimates are subject to the errors and uncertainties described above.) It is estimated that approximately 6% - 7% of all residential addresses in Australia are at risk on this basis.

	Qld	NSW	VIC	SA	NT	TAS	WA	ACT	Aust
Total Dwellings(000s)	1,356	2,344	1,731	584	65	181	696	115	7,071
Cumulative Flood Exposure (000s)									
1 in 20	22.2	25.0	7.9	2.1	0.1	0.3	0.4	0.0	57.9
1 in 50	46.1	42.8	28.9	4.6	0.5	0.5	0.8	0.0	124.3
1 in 100	63.3	58.1	44.5	6.6	1.0	0.7	1.1	0.0	175.3
1 in 1000	116.7	113.2	78.1	12.4	1.9	3.5	3.1	0.0	328.8
1 in 5000 (PMF)	154.1	151.7	101.6	16.4	2.5	5.5	4.4	0.0	436.1
% Flood Exposed									
More than 1 in 100	4.7%	2.5%	2.6%	1.1%	1.5%	0.4%	0.2%	0.0%	2.5%
Less than 1 in 100	6.7%	4.0%	3.3%	1.7%	2.3%	2.6%	0.5%	0.0%	3.7%
Total	11.4%	6.5%	5.9%	2.8%	3.8%	3.0%	0.6%	0.0%	6.2%

Source: Finity "Flood Insurance: Indicative Risk Premiums" 2005

The striking feature of the table above is the differing degree of exposure by state, with Queensland the most exposed. Looking across river catchments (as seen through the comparison of flood studies in the following chart), the proportion of residences at risk of inundation vary significantly as well. Many reasons (historical and topographical) exist for differences in exposure by catchment.



Number of addresses per study area with ARI less than 100 years

The severity of damage (depth of inundation) experienced at individual addresses will vary for a given flood. Construction of individual properties (eg. on a slab or raised) will also impact the extent of the loss experienced at an address for a given level of inundation. Changes to the use of a property (eg building underneath a raised house) can change the level of exposure to future losses.

Other return periods (such as 1-in-50 and 1-in-1000) are not consistently available for all catchments meaning the 1-in-100 (aka Q100) level is the most widely reported.

6.4 Commercial Exposure

In addition to inundation risk and physical damage, exposure also exists from the consequences of floods, including outages to power and other essential services as well as the cost associated with the inability to trade during and after the flood event.

Businesses that are not directly impacted by flood water (i.e. not inundated) may still be impacted by the consequential aspects of the event. The extent of these additional losses depends greatly on the severity of the event and the degree that infrastructure is impacted. These losses can range from stock perishing or general business interruption as a result of loss of electricity or other essential services, to more subtle loss of profits from reduced trade and turnover.

Estimation of commercial exposure and subsequent losses is significantly more difficult than for residential addresses.

6.5 Public Exposure

The rehabilitation of public assets by means of substitution of funding from other sources raises the question of what is the true 'cost' that is being estimated. Simply delaying other sorts of expenditure means that there is an associated opportunity cost which is often ignored and extremely difficult to measure or estimate.

In many cases, the repair of severely damaged infrastructure renews it to a level that is significantly better than the state it was in prior to the damage being incurred. For example, rebuilding damaged sections of the Bruce Highway or other flood prone roads may simply involve repaving. Alternatively, it could involve significant works to raise the pavement above flood height and provide necessary drainage.

The types of public assets that may be damaged are also so broad (from sewage plants to museums) that in many cases it is not possible to predict the costs until the actual event has been witnessed and the damage understood.

Therefore, estimating the expected losses arising to public assets from a flood for the purposes of pre-funding is particularly difficult. The response to this difficulty may be to exclude certain types of assets or infrastructure from the estimate (and hence funding) or to put a significant 'risk margin' in any estimate to reflect the uncertainty.

6. Recommendation

The Institute recommends that

- **The Commission formally recognise the uncertainties involved in predicting flood risk and losses, and the associated problems that are created for funding by these uncertainties.**
- **The Commission recognises that flood models are useful tools but better models and data will not provide a solution in themselves.**

7. Equity and Affordability in Funding

An underlying foundation of any funding structure is to ensure that it meets appropriate 'fairness' tests. Fair is of course a definition subject to much debate, however consideration of some potential outcomes can give a useful guide to determine an appropriate definition of 'fair' that the funding solution will target.

In many cases, low socio-economic groups have been attracted to flood prone areas by lower house prices (which may be low as a result of the fact that the land is flood prone). These populations are therefore caught in a situation where they may not be able to afford to move to somewhere close to their present location but also can't afford the long term cost of staying if they have to bear the cost of floods.

If insurance is priced according to risk, premiums in flood prone areas can be very high, possibly unaffordable to many. Without compulsion to take out insurance cover, the present situation of no and under-insurance, with the expectation of some form of government bail out, will continue.

When a large number of properties are not exposed to the risk of flood, a relatively small contribution from the owners of those properties can aggregate to a sufficient sum to cover the significant costs expected in the exposed areas.

Such direct cross subsidies work effectively only where those not exposed to the risk are forced to contribute. This is because many people who are not exposed to flood risk see little value in paying for cover they don't need.

People not directly exposed to flood risk may not wish to voluntarily contribute funds after an event as they do not see the benefit that effective recovery of those at risk would bring the broader economy. Second order impacts, such as rising banana prices, are often difficult for people to recognise. Also, there may be resentment to paying costs for those people incurred by those who live in high risk zones and did not have adequate insurance coverage.

In rural areas, many towns developed at river crossings. In such locations it can only be expected that significant parts of the town are exposed to flood risk. In these towns, the most exposed parts are often the commercial precincts.

Simply shutting down those towns and relocating the population is not financially viable and in most cases not socially acceptable. However, the expected flood cost is so high that it cannot be borne entirely by the local community. Levees usually are unable to be built high enough to deal with probable maximum flood (PMF) level water without prohibitive cost.

Failure to understand the dynamics associated with cross subsidisation (and failure to adequately capture funds from sufficient low risk properties to subsidise the high risk properties) can lead to a funding structure that will ultimately fail.

Appropriate town planning can aim for long term solutions. Most of Australia is not subject to flood risk, however population densities in some flood prone areas have increased considerably in recent decades.

In any funding arrangement, a trade off will be necessary between equity and affordability. For the reasons above, it may be more effective to share the costs amongst the largest possible group, where those costs involve mitigation, including re-location, and loss funding.

7. Recommendation

Care must be taken to avoid funding solutions that will lead to the most vulnerable sections of society being unprotected.

To effectively subsidise flood costs, it may be necessary to draw in the widest possible range of participants, including those at minimal or no risk of flooding, to help fund the costs of mitigation and flood losses.

8. Relationship between Loss Funding and Moral Hazard

Moral hazard is the risk that an individual will act in such a way as to result in an ultimately favourable outcome for themselves, often to the disadvantage of others and in a way that may not be deemed socially acceptable and may even be considered fraudulent.

Funding structures can create moral hazard by failing to create sufficient incentives for risk mitigation, loss limiting or direct reduction of losses.

For example, if flood prone land is low cost, and a funding mechanism exists for all flood affected properties to be rebuilt following a flood, developers have no disincentive to build in such areas. Alternatively, if the funding mechanism has rules such as "only buildings built before year 2011 are included", future development will be impacted in a manner which may encourage appropriate outcomes.

No-strings-attached grants and hand-outs after an event has occurred may not encourage actions to avoid future loss. Where voluntary funding avenues exist alongside such grants, the knowledge of the existence of such grants will discourage the participation in the other voluntary solutions.

Co-insurance and other mechanisms such as partial or capped loss funding where parties receiving funding have 'skin in the game', can also create an incentive for individuals to manage and reduce risk. Ultimately, if the government is always seen to be the emergency funder, no such incentive will exist to take out private insurance.

Whatever the mechanism, clear signals must exist to stop inappropriate behaviour.

8. Recommendation

Care must be taken to avoid proposals that will ultimately increase the costs of flooding to the community through encouraging inappropriate behaviours amongst affected groups. For example, ensuring that proposals will not continue to encourage building houses in areas of high flood risk to standards that are not resilient to flood.

9. The Role of Funding in Mitigating Flood Risk

Without suitable mechanisms to mitigate flood risk, the costs associated with floods will continue to increase. Planning and construction regulations can be strong levers to mitigate future risks, and are most effective when there is an associated financial component.

Funds can be directed pro-actively toward mitigation activities to reduce the costs of flooding associated with existing assets. Funds can also be directed in such a way that growth in flood costs is better contained.

9.1 Protection of Existing Assets

Flood costs associated with existing assets can be greatly reduced through well directed funding. The potential targets for funding include:

- Construction of new dams and raising the walls of existing dams,
- Construction of new flood levee walls and the raising of existing levee walls,
- Other public works such as flood deviation and drainage works,
- Buying back properties at extreme risk of flooding,
- Raising the height of at-risk assets (such as road works, raising houses, etc).

The effectiveness of each of these approaches depends, among other things, on the river catchment and the extent to which the approach has been previously used in the catchment.

In most cases, the reduction in costs associated with flooding can be many times the cost associated with pre-emptive mitigation works and thus this sort of funding can be far more effective than post-event recovery funding.

Many of these approaches described above have the benefit that they do not require explicit choices to be made on matters such as affordability compared to equity.

9.2 Limiting Growth in Flood Exposure

Population growth invariably puts pressure on planning authorities to release land in areas that are known to be flood prone. Funding can be used as an incentive (for land owners to reduce the exposure) or disincentive (against land owners increasing exposure). Such methods include:

- Attaching conditions to flood recovery funding whereby the funds are only available for reconstruction that meets certain criteria.
- Grants available to owners who are renovating properties in flood prone areas where the renovation works will result in the property being at a reduced risk of flooding.
- Precluding properties from funding eligibility under certain circumstances, such as built after a certain date and floor height below a certain height.
- Funding education programs to enable the public to make better informed decisions about the use of flood prone land.

9. Recommendation

The Institute recommends that The Commission formally considers ways to reduce risks to existing assets as well as limiting growth in exposure.

10. Mechanisms for Funding Volatile Losses

The size and frequency of catastrophic events are unpredictable. Natural disasters tend to have unique features due to location, type and size of catastrophe and the extent of human habitation and development in the affected region. Even when a similar event reoccurs in the same area, the extent of damage caused may be significantly different to that from the original event. This could be due to demographic changes such as increases in economic wealth, property development in higher risk areas or the development of defences such as levees.

Losses arising from catastrophe risks are very difficult to predict, and this makes it difficult to determine an appropriate insurance premium. Even if priced rationally, the premiums may prove to be unaffordable for the areas most at risk. Hence, private insurers are often not prepared to fully underwrite these risks and many countries have legislated national insurance schemes to cover losses from such events.

10.1 Public Funding

The structure of legislated national insurance schemes varies in a number of factors, including:

- Participation: voluntary, mandatory or compulsory

  "Compulsory" means natural events insurance is required regardless of whether the underlying property is otherwise insured.

  "Mandatory" means natural events insurance is only required when the underlying property is insured.

- Role: direct or reinsurer

  "Direct" means the Government plays the role of a direct insurer entering a contractual agreement with the policyholder.

  "Reinsurer" means the Government plays the role of a reinsurer providing capital support and sharing the risks with the insurers offering the coverage.

- Coverage: single hazard or comprehensive insurance
- Levy: standard or risk rated
- Reinsurance: commercial or self borne

10.1.1 Overseas Examples

As an illustration of the different forms a national insurance scheme can take, the details of several existing schemes are set out below.

- **Spain** (direct mandatory comprehensive cover)

  The natural disaster coverage in Spain is offered by the Consorcio de Compensacion de Segaros ("Consorcio") which was established in 1954.

The Consorcio offers comprehensive coverage and was part of the Finance Ministry until 1990. In 1990, it became an independent public company.

Spanish law states the events considered as natural events, and hence covered by the Consorcio.

A levy is mandatory and charged to fire, motor, accident and other property insurance contracts. The levy is either a percentage of the insurable value, or a fixed amount per vehicle or per person. It is collected by private insurers in return for reimbursement of costs. However, claims are handled and settled by the Consorcio.

Insured parties can also opt for supplementary private insurance coverage or a higher sum insured with Consorcio. The Consorcio prescribes a minimum insured value but no cap on the maximum value.

The Cornsorcio is not reinsured, hence the Spanish Government bears Cornsorcio's uninsured risk, and effectively guarantees the solvency of the company.

- **Japan** (indirect mandatory single hazard cover)

The Japanese Earthquake Reinsurance ("JER") vehicle was established by the Japanese Government in 1966 to govern the earthquake coverage for homeowners and storekeepers under the Earthquake Insurance Law. Coverage for commercial properties has no government involvement.

Under the law, homeowners and storekeepers have the option to take earthquake coverage for both buildings and contents. The coverage is limited to 30% to 50% of the amount insured, with a cap on the maximum sum insured.

If the overall losses reach a certain point, the claims will be pro-rated (that is, all claimants will receive less if total losses are high).

All insurers providing domestic earthquake insurance share the risks with the JER. The JER is not reinsured overseas, and hence the risk is retained within Japan.

- **France** (indirect voluntary comprehensive cover)

The French government reinsurance agency, Caisse Centrale de Reassurance ("CCR") was established in 1979. All insurers in France are obliged to provide natural events cover, but can choose to reinsure with CCR or private reinsurers.

What constitutes a natural event is largely unclear and can be politically driven. A natural event is only defined as such after an event has occurred.

The reinsurance covers offered by the CCR are substantially different from those offered by private reinsurers, with

1. The French Government providing CCR with an unlimited financial guarantee. Hence CCR has unlimited liability, as compared to JER where liability is capped.

2. The CCR offers a proportional reinsurance arrangement (ie. CCR pays a percentage of losses) and a stop loss arrangement (ie. CCR pays all losses abve a certain point).

With the exception of "storm risk", the premium charged by the insurer is determined by the Government. The premium is simply a percentage of the premium of the underlying policy. This premium structure offers no incentive for the insurer to underwrite the natural hazard risks accurately, exposing CCR to potential moral hazard and adverse selection. The financial performance of CCR to date has been poor.

- **United States** (direct voluntary single hazard cover)

The United States National Flood Insurance Program ("NFIP") was established in 1968 to provide flood coverage to both residential and commercial buildings. Coverage from NFIP is only available in communities that adopt and enforce flood plain management ordinance that meets or exceeds the required minimum NFIP standards.

The purchase of flood insurance, when available within a community, is mandatory if the property is mortgaged, but otherwise voluntary. The premium rates are generally actuarially determined and discounts are available for policyholders who have undertaken flood risk mitigation measures. To encourage participation, premium subsidies are available for flood prone communities or buildings constructed before the Flood Insurance Rate Map ("FIRM").

- **New Zealand** (direct mandatory comprehensive cover)

The New Zealand Earthquake Commission ("EQC") was established by the Government in 1954 to provide natural events insurance to domestic buildings, contents and land.

Natural events covered by the EQC are defined within the Earthquake Commission Act. The coverage is broader than earthquake, and includes floods, storms, tsunami and volcanic eruptions. The cover is mandatory with domestic property insurances and provides limited

cover. Private insurers can provide additional cover above the limit or for risks not covered by the EQC.

The levy is calculated as a rate per $100 sum insured.

The EQC purchases reinsurance with international reinsurers. It is likely that the EQC reinsurance cover was exhausted in the 2011 Christchurch earthquake meaning that losses beyond the cover provided by the reinsurance treaties would be borne by the EQC, which is effectively underwritten by the New Zealand government.

10.1.2 Post-Event Funding

Where funding is either not built up in advance of an event or has been accumulated to a level that is insufficient to meet the cost of the event, it is necessary to raise funds after the event.

Governments are able to raise funds via a number of mechanisms. These include:

- **Taxes and levies**

  Taxes and levies can be tailored to the magnitude of the funding requirement through the level of the tax and duration of the fund raising period.

  Funds are raised over time, meaning that there are cash flow considerations, where short term payments will need to be funded in advance of the tax revenue being collected.

  Social goals of the government can also be achieved through the design of the tax, including allowance for income thresholds and geographic concerns (i.e. the people in the affected area are not taxed).

  Distinction can also be drawn between taxation of:
  - personal incomes;
  - company/business incomes;
  - superannuation or investment earnings, and;
  - general consumption (GST).

- **Issuing debt instruments**

  Most governments have an enviable credit rating which allows them to access debt markets at much lower costs than the private sector.
  Innovative instruments such as Catastrophe Bonds can provide an instant source of funding through their underlying design. That is, following a prescribed catastrophe the bond's face value falls to zero, meaning that the money raised by the sale of the bonds does not need

to be repaid to the private sector investors, therefore freeing it up for use in catastrophe payments.

Of course, where traditional debt is issued, the term of the debt (and repayment obligations) can be design to align with government revenue (tax) expectations.

Catastrophe bonds may be an effective funding mechanism for natural disasters. This includes the possibility of government issued catastrophe bonds.

- **Redirecting existing revenue from other government projects**

In local and State government environments, it is not uncommon to simply delay other projects in order to provide post-event funds. As well as the opportunity cost caused by the delay of other projects, the main disadvantage is the real upper limit that exists on the funds available. It is not possible to divert all government revenue to disaster relief and even if it was, the amount of available revenue may not be sufficient.

Furthermore, the ability to fund subsequent events that may occur in a short period after a major event is hampered by the exhaustion of funds through the first event.

10.1.3 Ongoing fund raising

Where funds are accumulated on a pre-event basis, management of those funds needs to be considered. Examples in Australia include the 'Future Fund', which is effectively a large investment pool.

Funds would be drawn down following events in accordance with the scheme design rules. A feature may also exist to allow funds to be drawn down to fund mitigation works.

Due to the potentially long time between events, it may be the case that the accumulated fund reaches a threshold where consideration needs to be given to defer additional fund raising. Alternatives to this include diverting excessive funds to other 'nation building' projects.

Catastrophe bonds allow funds to be raised from the private investment sector (at a certain interest rate) in advance of an event. These funds are then released when a catastrophe (as defined) occurs. The interest payable, less any recoveries, is the 'public cost' of catastrophe bonds. This cost can be clearly quantified and recouped through other funding mechanisms, such as tax.

Catastrophe bonds are in essence insurance. The interest paid each year is the 'premium' paid for the cover and the face value of the bonds on issue represents the 'sum insured'. The value of bonds issued before the event will be

the upper limit of funding available to fund event response. Once exhausted, other forms of post-event funding will be required. New bonds can also be immediately issued for funding further events in the future.

Further design elements of catastrophe bonds are beyond the scope of this document.

10.1.4 The Opportunity Cost of Pre-Event Funding

The key advantage of post-event funding compared to ongoing funding in this context relates to the aforementioned volatility of events. Extreme events are very infrequent, and ongoing fund raising may take place for many years before an event occurs that requires the funds.

The cost on the community (or economy) of ongoing fund raising may ultimately reduce growth. Post-event funding only presents a temporary cost to the community after the event, and the short term impact on growth is limited to the severity of the event and the post-event funding mechanism selected.

Post-event funding is arguably the more efficient form of funding for government disaster response, albeit with a lumpier cash flow profile. Ongoing funding smooths out the lumps.

10.2 Private Funding

Traditional insurance policies, where cover is provided for a set period of time, to a set amount (or definition) in exchange for a periodic premium payment, are the main source of funding for non-government assets. The consumer buys this on a voluntary basis.

The insurance industry is a competitive industry where companies differentiate themselves on price, service and cover. Insurance companies are experienced in paying claims and are therefore well placed to manage fund distribution and rehabilitation, repair and replacement works for major events.

Mechanisms where insurance companies collect premiums and manage claims on behalf of a scheme in addition to the premium and claims provided on their own insurance policies can also be implemented.

Premiums paid for insurance cover the underlying expected claims cost (risk premium), the cost of handling claims, the cost of administering policies and the profit margin expected by the owners of the insurance business (often shareholders) to provide their necessary return on capital.

In some states of Australia, significant charges and levies are placed on some classes of insurance policy, meaning that the risk premium represents only a small proportion of the total premium paid.

The *Insurance Contracts Act* (1984) prescribes minimum cover levels; however, each insurance company is left to define the exact cover in their Product Disclosure Statements (PDS). Whilst being a feature of a competitive market, this fact also means that ultimately at claim time there can be differences in the level of cover available to an individual depending on the insurer.

As seen in the recent flood response, many people found they were not covered for the sort of flooding they experienced. Others could not afford the cover that was available and therefore simply did not buy insurance.

The interplay of public sector funding and disaster response, and the private sector insurance market needs to be considered in the design of any scheme. Importantly, where no incentive exists to buy insurance for highly exposed risks, the people who do buy insurance end up paying twice – firstly for their own cover and secondly through taxes or donations for the high risk people who did not buy insurance and instead get money from elsewhere.

Insurance companies buy reinsurance to protect against major losses that exceed the level they are comfortable accepting. International reinsurers provide cover for insurers across the globe.

Reinsurers provide total cover to many times the premium they collect on the basis that – world wide – many companies buying cover will not need it and will be able to be pooled with locations where losses are experienced. However, there does exist a theoretical upper limit to the amount of cover that is available in each region of the world.

Whilst some countries (such as New Zealand with the EQC) do already access private reinsurance markets, large countries like Australia with significant catastrophe exposure may find there simply is not sufficient capacity available to provide similar cover.

Where reinsurance capacity does exist it may be very expensive, involve a considerable 'retained cost' to the purchaser (the reinsured) as well as a limit beyond which the costs fall back to the reinsured to be funded directly. Recent events in Australia, New Zealand and Asia are expected to see the cost of reinsurance increase significantly. This increase in reinsurance costs will flow through to increased insurance premiums.

10.3 Public Sector Use of Private Funding

Where the public sector is considering the decision to access the private sector (such as reinsurance markets) for its flood funding needs, the following points are worth noting:

- The cost of debt for federal and State governments in Australia, afforded by their very strong credit rating, is usually much lower than the equivalent (return on equity) expected by the owners of reinsurance companies.
- It is not trivial to decide how much cover is required.
    - Catastrophe cost modelling is an inexact science.
        - New Zealand EQC had purchased an amount of reinsurance that it believed would be sufficient for a 'Wellington PML'.
        - Both recent earthquakes in Christchurch, previously considered a lower risk than Wellington, exceeded the amount of cover EQC had purchased.
    - The event costs above the amount covered by the reinsurance need to be covered by the government.
    - The event costs below the attachment point of the reinsurance need to be covered by the government.
- The design of the cover needs to consider the chance of multiple events in a given period and the extent that protection is desired for multiple events.
- The amount of cover that is required may exceed the amount that is available.
- The cost of the cover may vary considerably over time in line with reinsurance market cycles, meaning that a steady budgeted funding amount may be insufficient in some years to buy the necessary cover.
- It may be necessary to reduce the amount of cover purchased if sufficient funding is not available to buy the full amount required.
- Careful consideration needs to be given to which public assets will be covered by the reinsurance and what types of events will be included.
    - The more that is included in the cover, the more expensive the cover will be.
    - The uncertainty relating to the estimation of losses for certain types of assets (such as roads) may be much higher than for

other types of assets, thereby adding a disproportionate amount to the cost of the cover.

10. Recommendation

The Institute recommends that the Commission note.

- **the Federal government may be considering a nationwide response to disaster mitigation and funding,**
- **that both public and private funding have a role to play in funding flood losses, and**
- **overseas examples exist that may be useful to draw from.**

11. Engaging the Public in Funding Flood Risk

Flood is traditionally something that people do not think will happen to them. In some cases this is valid (they live at the top of the hill), whilst in other cases it is not. Due to the significant proportion of the population in Australia that is not at direct risk of flood, as demonstrated in section 6.3, and the massive costs that relate to the proportion that is at risk, the ultimate success of any funding solution will rely on effectively engaging the whole population. This involves those not at risk subsidising the costs of those at direct risk of flooding.

One way of making more people value such cover is to widen the definition of the cover that is on offer. In other words, expanding the definition of the cover from specifically flood to also include other natural hazards can serve to take the focus of flood and reduce the amount of natural insouciance.

The Medicare levy and the associated penalty tax on high income earners who do not have private health insurance is an example of a mechanism to encourage the public to purchase appropriate cover. Of course, if such cover is still prohibitively expensive, many will simply choose to pay the penalty tax.

11. Recommendation

The Institute recommends that the Commission consider funding solutions that make flood loss funding transparent and shares costs across the community in a way that encourages effective risk management.

12. Flood Risk and Risks Presented By Other Natural Hazards

Queensland has significant exposure to a number of major natural hazards beyond flood, including Cyclone and Thunder/hail Storm risk. No other state in Australia has as much exposure to weather-related natural hazards. This feature creates a further challenge to Queenslanders on their own funding of flood and natural hazard exposure in Queensland.

Natural hazards are generally considered random events. Whilst these events may occur in some areas in a broad sense more often than other areas, the exact place where the event will occur is inherently random. In some cases other events can coincide with flooding events (eg rainfall associated with a cyclone causing a flood). This makes separation of the damage arising from events difficult in some situations.

Flood can be characterised well by the phrase "it's not if, but when". Whilst rainfall will occur across the catchment in a random way, once the water has reached the ground it will flow through a defined course and impact properties in defined locations. So it becomes a matter of time before a sufficiently large rain event occurs in the catchment for the resulting flood damage to be incurred.

This inevitability aspect means that some insurers are reluctant to cover properties for flood whilst being willing to provide cover for other natural hazards. Identifying such properties has, until recently, been difficult and so some insurers have responded by not offering flood cover.

In a competitive market place (with no regulation relating to pricing or risk acceptance) and as identification of at-risk locations becomes easier through advancements in modelling and more readily available data, insurers will seek to remove cross subsidies in their pricing or not offer cover at all in some locations. In other words affordability or availability of cover for at-risk addresses will worsen as data improves.

Insurers do this because they do not want to be selected against and have a group of flood risks that they have not collected sufficient premium for. Indeed, an insurer that does not price effectively for flood-exposed risks in a competitive market place will need to increase their premiums for all their customers (including those not at risk) to fund this over time.

The advancements in data relating to flood risk are also happening with other natural hazards. Some insurers have withdrawn from offering cover in the north coast of Queensland as their understanding of cyclone exposure has increased (or as their own reinsurance costs have increased due to cyclone models, used by reinsurers to determine their premium, have advanced).

At the same time that Queensland insurance customers are finding it difficult to afford or find flood cover, they may also be finding it increasingly difficult to afford or find insurance cover for other weather-related events. The National Disasters Insurance

Review is expected to recognise this problem as it relates to Queensland and the overall funding challenges faced by Queensland as a result of its geographical location natural features.

12. Recommendation

The Institute recommends that the Commission's conclusions recognise the very local aspects of flood risk and the fact that, without some form of regulation or intervention, private market competitive mechanisms will result in the cost burden being isolated to the areas identified as being at-risk and therefore protection being either unaffordable or unavailable in these areas.