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APPLYING UNHARMED FOR RISK REDUCTION PLANNING – COMPARING STRATEGIES AND LONG-TERM EFFECTIVENESS

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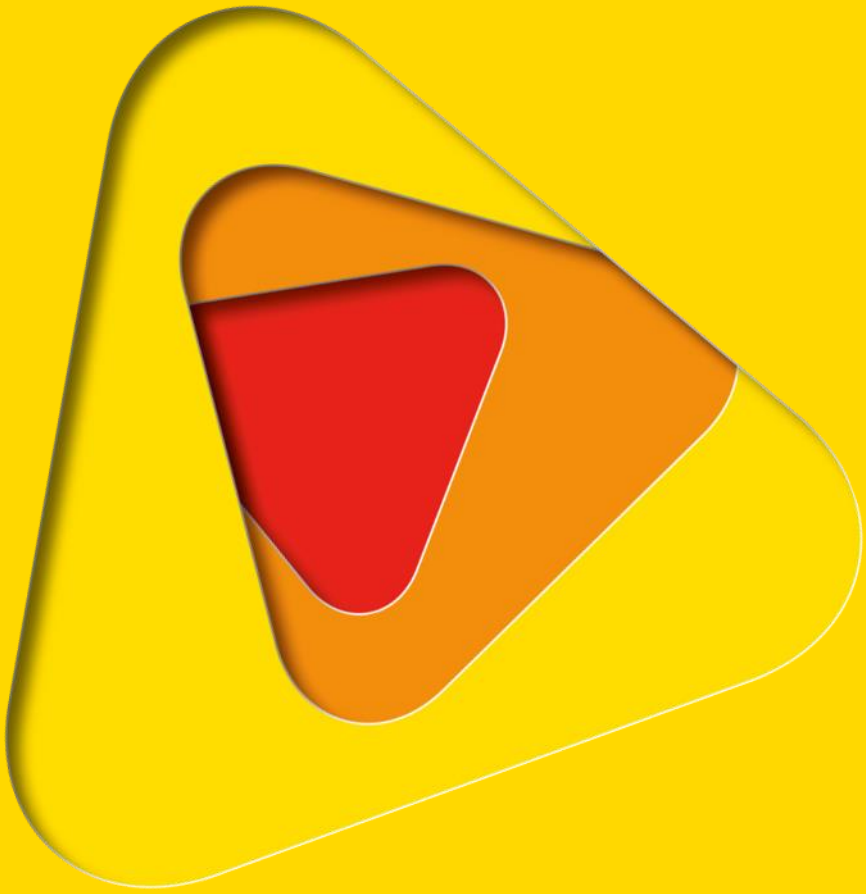

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ABSTRACT

APPLYING UNHARMED FOR RISK REDUCTION PLANNING – COMPARING STRATEGIES AND LONG-TERM EFFECTIVENESS.

Natural hazards are an unavoidable component of life in Australia. Analysis shows the average cost of natural hazards in 2015 totalled $9.6billion, and this figure is projected to increase to $33billion by 2050 (Deloitte Access Economics 2015). These figures correspond to a substantial impact and coupled with the social and environmental impacts of disasters, paint a bleak picture. However, as tomorrow's risk is a function of today's decisions with effective risk reduction planning there is significant scope to minimise tomorrow's impacts. The challenge though exists in that ex-ante analysis on the long term effectiveness of risk reduction strategies, the type of analysis required to justify significant investment and policy decisions, is challenging given the dynamic, complex nature of disaster risk, and the length of assessment period required to consider returns. In response to this and to support improved understanding of future risks and ex-ante testing of risk reduction solutions a tool was developed between researchers and Australian government agencies.

The tool – UNHaRMED - consists of a dynamic, spatial land use change model and multiple hazard models to consider how risk changes into the future both spatially and temporal. UNHaRMED was developed through an iterative, stakeholder-focussed process to ensure the system was capable of providing the analysis required by policy and planning professionals in emergency management and risk fields. The process involved a series of interviews and workshops with members of the various State Government agencies, aligning risk reductions to be included, policy relevant indicators and future uncertainties, such that the system can sit within existing policy processes. This resulted in a tool that considers how land use changes into time, how various hazards interact with these changes, and what the effectiveness of a variety of risk reduction measures is.

Its design was tailored to specifically account for the challenges around developing and implementing risk reduction options. These include the difficulty of convincing decision makers of the advantages of spending money on mitigation works compared with the short-term benefits offered by other potential projects and activities. In addition, because disasters are relatively infrequent, the people influencing risk reduction activities may have little personal experiences to guide their evaluation of risk, or the relative benefits of alternative risk reduction options. Furthermore, risk reduction budgets are generally limited, and given the difficulties mentioned above, the selection of an optimal set of risk reduction options is very difficult when many alternative options are available.

UNHaRMED has been designed to assist in addressing these challenges by (1)being transparent and quantifying the expected benefits of risk reduction investment across multiple criteria, enabling strong arguments for the selection of particular options to be made, (2) it can be used to assess the likelihood and consequences of natural hazards across multiple criteria, resulting in less bias when assessing the relative benefits of risk reduction options, and (3) can make use of formal optimization techniques to find optimal or near-optimal portfolios of risk reduction options.

It includes the assessment of risks from multiple natural hazards, currently bushfire, earthquake, coastal and riverine flooding, over extended temporal horizons, looking at how the average annual losses from each of these hazards changes each year. Along with the assessment of how risks change into the future for each of these hazards, importantly, the system also allows the modeller to implement various risk reduction options including changes to the building code, property retrofits, land use planning strategies, land management strategies and structural flood reduction methods, to assess their effectiveness.

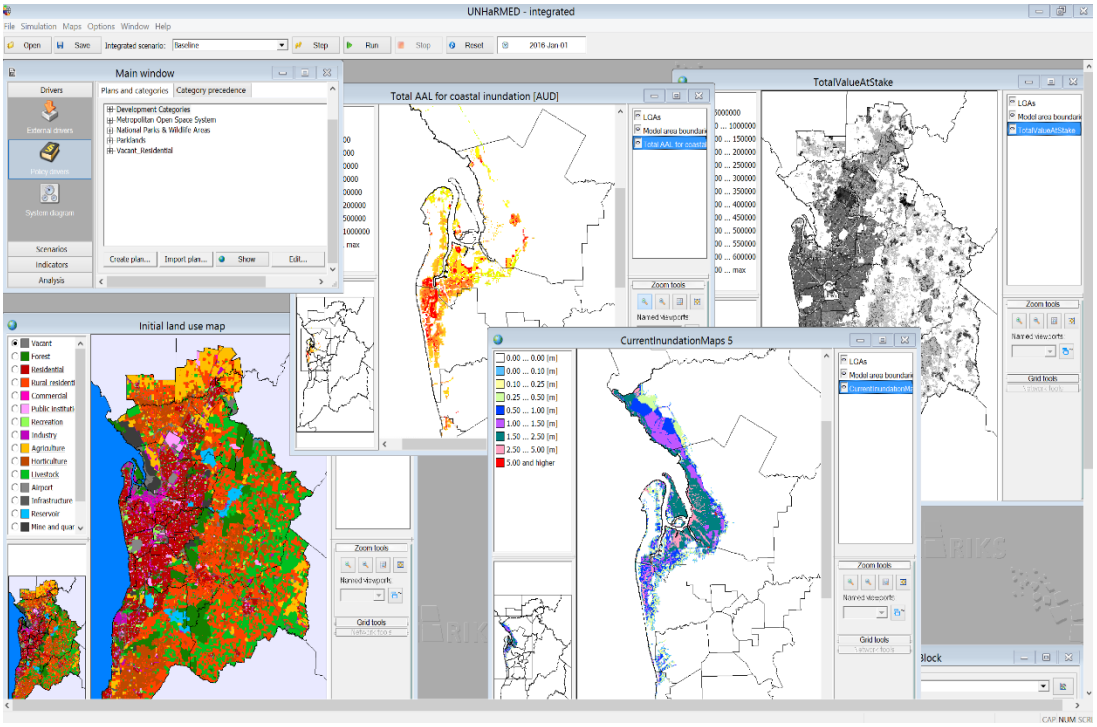

FIGURE 1 - SCREENSHOT SHOWING EXPOSED VALUES, INUNDATION FROM COASTAL FLOODING, AND ASSOCIATED AVERAGE ANNUAL LOSSES FROM THE GREATER ADELAIDE APPLICATION OF UNHARMED.

UHaRMED begins with considering how external drivers such as population and economic change impact the exposure components of risk. This is achieved via a land use and building stock model that translates projections into a spatial grid of land use type and associated building stock types and finally values per cell per year. This represents the values at risk per year. Hazard models are also impacted by these external drivers such as population growth impacts on the ignition potential considered with bushfire hazard model, climatic factors are also external drivers that impact on the likelihood and severity of natural hazards. Vulnerability functions are used to determine the losses based on the severity of hazard events and the values at risk. This follows the concept of the 'risk triangle' considering elements of hazard, exposure, and vulnerability for risk assessment.

By considering each of these elements individually risk reduction strategies can be devised that utilize the full range of options instead of more traditionally focusing on hazard management, through land management or structural flood defenses for example. Figure 2 highlights this idea by showing the potential for commercial development in Adelaide. This potential is a function of existing commercial developments, and its relationship to other land uses such as distance to residential areas or the CBD, accessibility in terms of transport access and the zoning of land based on South Australian Local Government zoning schemes. For policy-makers to

influence future risk they can improve the accessibility of an area, or change the zoning (either stimulating or restricting particular land use) to see the shift the growth of commercial development into less risky areas. Property developers could similarly use UNHaRMED to consider which areas currently are comparable in terms of development potential but elect to develop on one not exposed to future coastal flooding issues.

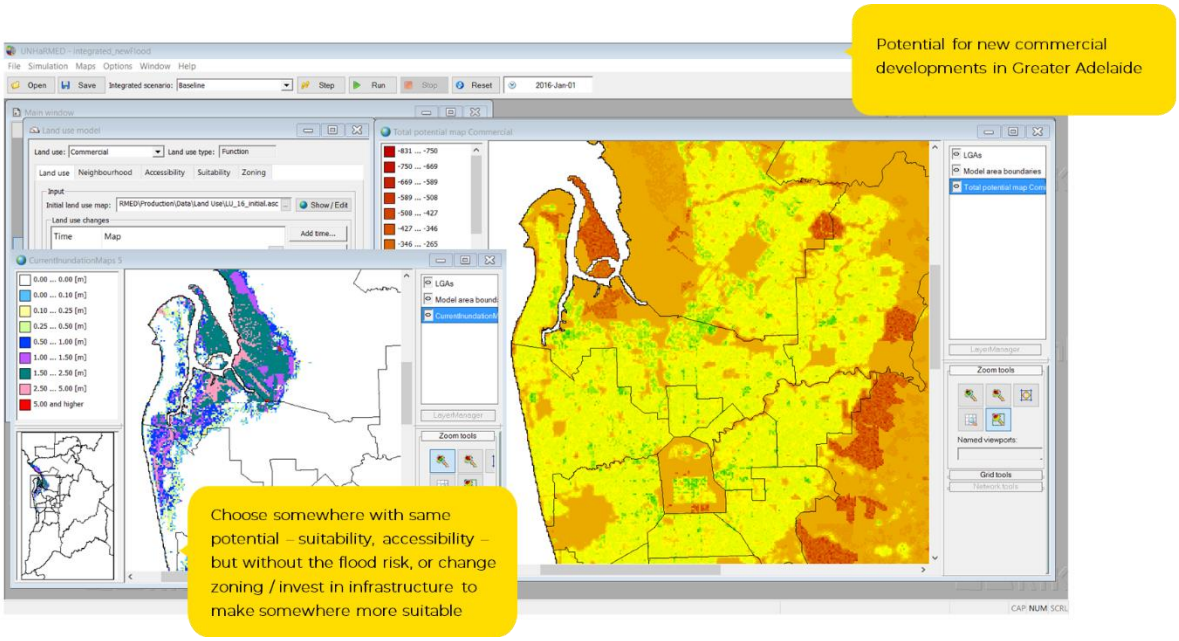

FIGURE 2 – OVERVIEW OF POTENTIAL FOR COMMERCIAL DEVELOPMENT IN ADELAIDE AND FUTURE COASTAL INUNDATION RISK FROM A 1IN200 YEAR EVENT IN 2050 UNDER CLIMATE CHANGE SCENARIO RCP 8.5

The effectiveness of such policy changes in reducing risk can then be tracked by UNHaRMED considering how the average annual loss changes over the planning horizon, or by considering the losses and properties impacted by a specific event (such as an 1in100 year flood). Structural risk reductions can also be implemented to reduce the impacts of flooding, as shown in the comparison between Figure 3 and 4.

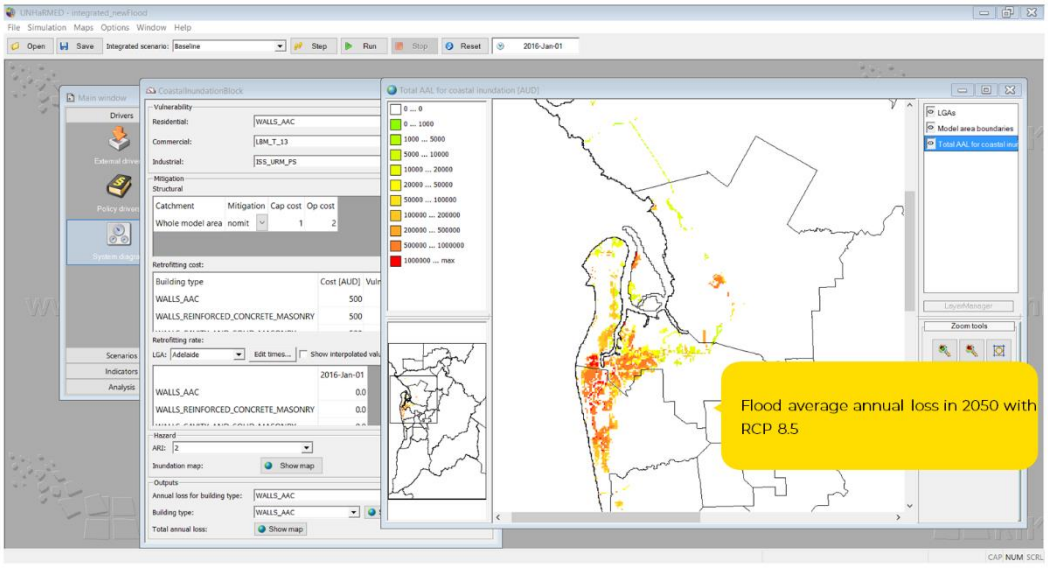

FIGURE 3 – COASTAL FLOODING AVERAGE ANNUAL LOSS IN 2050 UNDER RCP 8.5

These show the reduced average annual loss between coastal flooding in the Port Adelaide region in 2050 from the implementation of structural mitigation options (sea-walls) protecting against the 1in100 year event (based on 2050 RCP 8.5). Policy-makers and planners can therefore compare the difference in effectiveness between zoning strategies that shift developments to different areas, implementing raised floor-levels for new developments subject to flooding impacts or the construction of sea-walls.

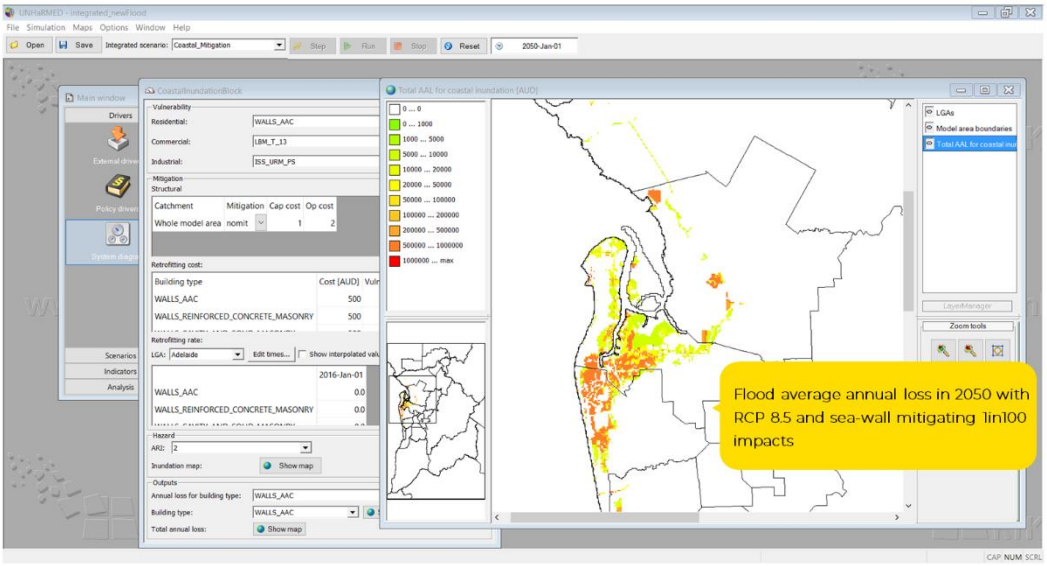

FIGURE 4 – COASTAL FLOODING AVERAGE ANNUAL LOSS IN 2050 UNDER RCP 8.5 WITH STRUCTURAL MITIGATION FOR 1IN100 YEAR FLOOD EVENTS

UNHaRMED is now being provided to multiple state agencies across South Australia, Victoria, and Tasmania to support transparent and robust decision-making for risk reduction activities. The software takes risk analysis and risk reduction planning into a more complex and comprehensive space. It achieves this by coupling the analysis of risk reduction with cost-benefit analysis and socio-economic-environmental values and impacts to provide a more holistic view of the various mixes of risk reduction measures. Given risk reduction and resilience planning has very strong social and environmental dimensions, it is intended UNHaRMED can lead to more transparent and robust policy settings and decision-making in an integrated and holistic manner. The software is continuing to be developed and implemented in three states in Australia across emergency services, planning and environmental protection agencies.

REFERENCES

1 Deloitte Access Economics, 2013. Building our nation's resilience to natural disasters. Australian Business Roundtable for Disaster Resilience and Safer Communities.