Tasmanian Emergency Risk Assessment Guidelines

TERAG 2017

VERSION 1.0

Department of Police, Fire and Emergency Management

Tasmanian Government

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Acknowledgements

The materials in this guidelines have relied heavily on the work of the Western Australian Office of Emergency Management (formerly the State Emergency Management Committee Secretariat); the authors acknowledge and appreciate the high level of support and collaboration provided. The guidelines reflect elements of the Tasmanian State Natural Disaster Risk Assessment, in particular risk criteria and controls identification. The adoption of these and the support of the authors have made a valued contribution to the guidelines. Further to this, members of the Tasmanian emergency management community have been generous with their time and knowledge as members of the Project Steering Committee, the Technical Advisory Group and End Users Group.

The Tasmanian Emergency Municipal Risk Assessment Project is an initiative of the State Government of Tasmania and is joint funded under the Commonwealth Government's National Partnership Agreement on Natural Disaster Resilience.

ISBN: 978-0-6481509-0-9

Date: 8th September 2017

Version: 1.0

Contents

Foreword

Tasmanian Emergency Risk Assessment Guidelines and Tools

Tasmania is exposed to an increasing number of risks generated by the natural, built and technical environments, and the deliberate or negligent actions of people. The State Emergency Management Committee (SEMC), as the peak body administering emergency management in Tasmania, has identified the need to apply a more simple, consistent and transparent approach for emergency management committees and hazard management authorities to identify, analyse, evaluate and treat these risks.

Risk assessment is the backbone of decision making when setting priorities for emergency management programs. It allows us to understand the hazards that communities, infrastructure, values and assets are exposed to and the consequences that an event may generate for people, the economy, the environment, our social structure, and the delivery of services and governance. It allows us to consider what we are currently doing to manage these risks, if that is adequate, and if and where we need to improve. It is a collaborative approach based on evidence and reflects the directions of the United Nations, Australian Government and other State Governments to reduce risk at its source.

These guidelines and tools enables users to undertake consistent risk assessments and design strategies and programs to treat the priority risks that they own. I commend these guidelines and tools to you and look forward to the contribution they will make to a safer and more resilient society in Tasmania.

Commissioner Darren Hine
CHAIR, STATE EMERGENCY MANAGEMENT COMMITTEE

Introduction

Tasmanian emergency risk assessment guidelines

The State Emergency Management Committee (SEMC) has prepared these guidelines to support Tasmanian emergency management committees and hazard management authorities to prepare emergency risk assessments in line with the National Emergency Risk Assessment Guidelines (NERAG), handbooks 10 and 11. It is anticipated that these guidelines and associated templates and tools will provide an easy-to-follow process that produces consistent and reliable risk assessments. These assessments will provide the basis for maintaining current works and identifying new projects to manage existing and emerging risk to Tasmania's people, economy, environment, society and administration. These guidelines complement the risk assessment process in the SEMC *Tasmanian Emergency Management Plan* (TEMP) (in development) and the draft *Emergency Management Planning Policy* (in development). The policy includes the Tasmanian Emergency Management Principles and Tasmanian Emergency Risk Management Framework.

This risk assessment guide reflects methodologies for risk management of natural hazards tested in the Tasmanian State Natural Disaster Risk Assessment (TSNDRA). Human-induced (man-made and behavioural) hazards such as intentional violence (e.g. terrorism) have not yet been analysed through a NERAG approach at State level. That said, the principles, framework and methodology outlined in this risk assessment guide are equally applicable to these hazards and should be used. Should further information be required relating to terrorism, Special Response and Counter-Terrorism (SRCT) at Tasmania Police provide the focal point for Tasmanian Government counter-terrorism activities. SRCT can provide advice on security risk assessments as they relate to terrorism (SRCT@police.tas.gov.au).

In accordance with the SEMC draft *Emergency Management Planning Policy*, emergency risk assessment must be undertaken in accordance with this guide.

Tasmania

The islands of Tasmania (Figure 1) are an Australian state, covering 68,401 km^2 and situated some 250 kilometres off the mainland's south-east coast. Tasmania is bisected by the 41st (south) degree of latitude and has a cool climate driven by strong westerly wind flows. Tasmania has a maritime focus and includes King Island and the Furneaux Islands in Bass Strait and the sub-Antarctic Macquarie Island.

Tasmania has a population of 515,000 people. Its population is concentrated around the two cities of Hobart, the capital, in the south and Launceston in the north. The north-west coast maintains a concentrated strip of habitation between the towns of Devonport and Burnie. A large rural population is dispersed mainly through the north and east of the State. Tasmania has the lowest population growth of the Australian states at 0.66%. The resident population is trending up in age and becoming popular with mainlanders as a place to retire.

Hazards in Tasmania

The *Tasmanian Emergency Management Plan* 8 (TEMP Version 8)[1] identifies 32 hazards for Tasmania. These include both man-made, behavioural and natural hazards. Nine of these hazards were studied in depth in the 2016 Tasmanian State Natural Disaster Risk Assessment (TSNDRA)[2]. The assessment considered the likelihood of the event and the consequence of the event occurring. From the assessment, it was identified that risks associated with the occurrence of fire (bush) and flood were rated "high" and posed the greatest risk to Tasmania. Six other hazards were considered of "medium" risk; landslide was assessed as low risk (Table 1).

TABLE 1: TASMANIAN NATURAL HAZARDS RISK ASSESSMENT 2016

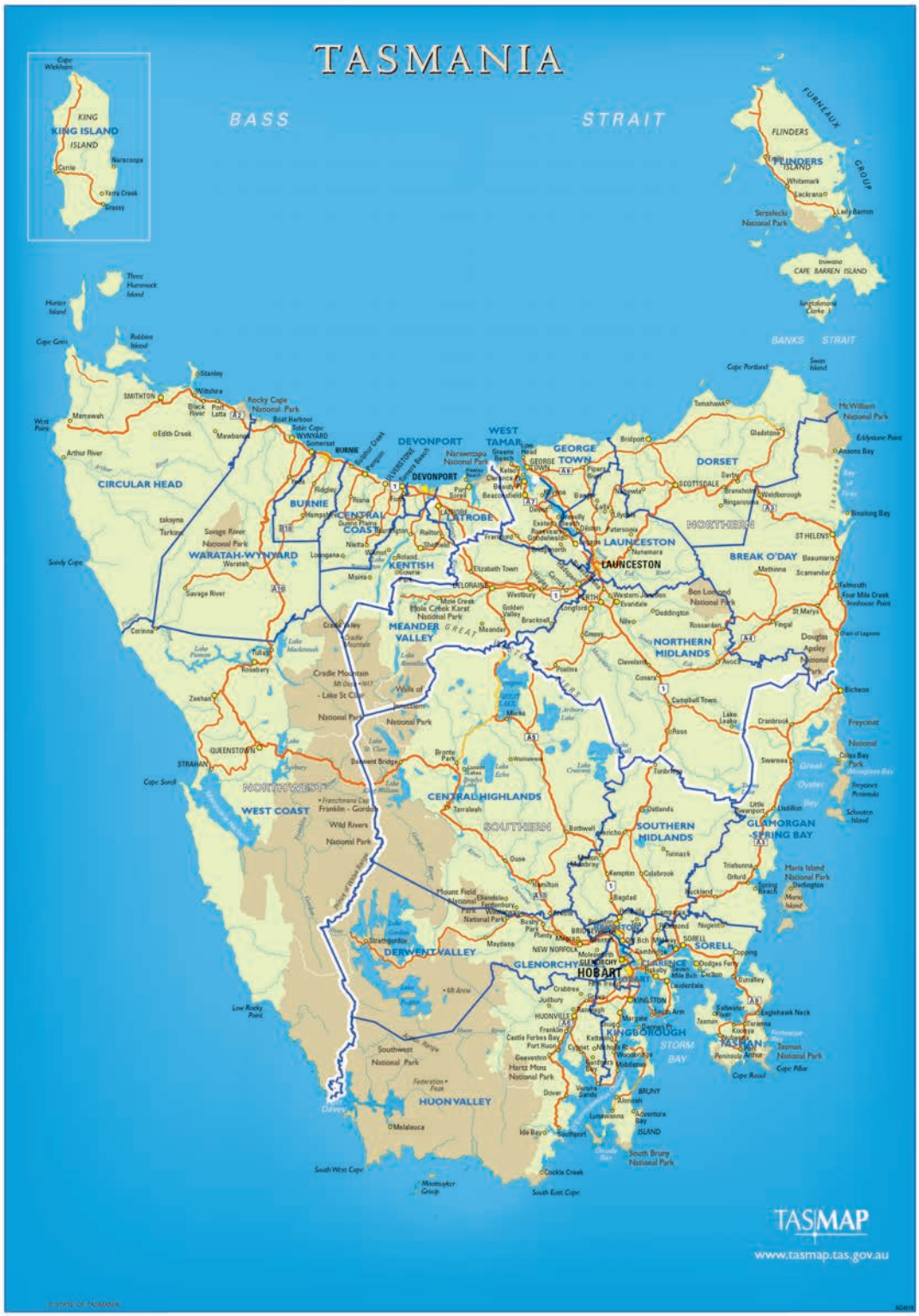
TASMANIA STATE NATURAL DISASTER RISK ASSESSMENT – RISK RATING			
Hazard	**Likelihood**	**Consequence**	**Risk**
Bushfire	Unlikely	Major	High
Flood	Rare	Major	High
Heatwave	Likely	Minor	Medium
Severe Storm	Unlikely	Moderate	Medium
Coastal Inundation	Unlikely	Moderate	Medium
Pandemic	Unlikely	Moderate	Medium
Tsunami	Extremely Rare	Major	Medium
Earthquake	Extremely Rare	Major	Medium
Landslide	Unlikely	Moderate	Low

Human-induced (man-made and behavioural) hazards have not yet been analysed through a NERAG approach at State level. These hazards include biosecurity, energy supply disruption, marine pollution, a number of built structure failures (dams, buildings, bridges), public health events (including food or water contamination,) hazardous/radiological material events (including nuclear-powered ships), transport crash, (aircraft, rail, marine, road vehicle, space debris) and intentional violence (including terrorism).

1 *Department of Police and Emergency Management, Tasmanian Emergency Management Plan*: Issue 8. 2015.

2 White CJ, Remenyi T, McEvoy D, Trundle A and Corney SP 2016, 2016 *Tasmanian State Natural Disaster Risk Assessment*, University of Tasmania, Hobart.

FIGURE 1: TASMANIAN ISLANDS



Events and their impacts and consequence

Tasmania has suffered a broad range of acute disaster events. Transport incidents have seen the sinking of many ships and a number of air crashes, health epidemics have been irregular but impactful, bushfires and floods more regular, and a number of industrial accident events have occurred particularly in the mining industry. The mass shooting at Port Arthur in 1996 shocked the nation to a point that changed the national consciousness and culture with regard to guns.

In June 1872, as a result of extremely heavy rainfall, a very large landslide occurred on the north-western slopes of Mt Arthur at the head of Humphreys Rivulet. A large debris flow then rushed down Humphreys Rivulet and through the township of Glenorchy, which was then a relatively low density farming and industrial area, and caused considerable damage and destruction. This significant event, along with other debris flows on the Wellington Range, serves to highlight the potential for dangerous debris flows initiating on the Wellington Range under modern climatic conditions. It is also apparent that the potential for serious consequences and risk to life of such an event is now higher due to the greatly increased housing density in the area[3].

The 1919 Spanish flu pandemic infected approximately one third of Tasmanians, leading to the death of 171 persons. In contrast to other flu's it was particularly impactful on 15 to 35 year old young adults.

The 1967 bushfires maintain a momentous place in Tasmanian history and psyche. The 100 plus fires that spread across more than a quarter of million hectares of southern Tasmania left 64 people dead, 900 injured, decimated animal herds (80,000+) and destroyed 1400 homes. The fire event led to significant changes to the regulation, arrangements and management of fire in Tasmania.

While the 1875 sinking of the *Cataraqui* on King Island with the loss of 408 lives represents the largest peacetime maritime disaster in Australia, it was the 1995 carrier ship, *Iron Barron*, incident that changed our thinking. The *Iron Barron* ran aground on Hebe Reef in the Bass Strait, which led to the release of 480 tonnes of heavy fuel oil and 53 tonnes of diesel oil into the marine environment. About 2000 seabirds were treated for oil contamination, and as many as 25,000 penguins and several thousand seabirds died. The clean-up lasted for 10 weeks. The sinking of the *Iron Baron* and its subsequent impact on seabirds was a turning point in our understanding of environmental consequence as a disaster.

3 *Tasmanian Geological Survey Record* 2016/02.

The Port Arthur mass shooting in 1996 killed 35 people and left 37 injured. Its impact was reflected in shock and horror across the country and the psycho-social recovery has been incredibly challenging. The consequence of this event included dramatic changes to firearm controls and licensing, and an increased focus on the mental health of the community.

The Tasman Bridge collapse in 1975 was the result of the *Lake Illawarra* bulk carrier ship striking pylons of the Tasman Bridge. Twelve people were killed: 5 motorists and 7 sailors. The bridge was the primary transport conduit between the east and west shores of the capital city, Hobart. The three years of social and economic disruption of the loss were so significant, it changed the function of the societies on the east and west sides of the river; social dislocation and isolation led to changes in transport, employment patterns, services, and even criminal activity.

Recently, extensive bushfires and floods have had widespread impact across all parts of Tasmania. It is anticipated that through climate impacts we will expect to see more regular and intense weather-driven disaster events.

These events have caused significant social, environmental and economic costs. The State Emergency Management Committee aims to reduce future impacts from similar events by employing an Emergency Risk Management (ERM) approach. This process seeks to identify, analyse, evaluate and treat sources of risk before, during and after an emergency event.

Structure of this guide

Part 1: Introduction and background CHAPTERS 1 2

Explains the significance of the emergency risk assessment process, its principles, practice and framework, and its context in Tasmania. It also details the method used to conduct the process in a workshop.

Part 2: Risk management process CHAPTERS 3 4 5 6 7 8 9 10

Describes the steps to be conducted before, during and after a workshop including the main five phases of the emergency risk assessment process. Each chapter has been set out with the following structure:

- Description of the step and why it is necessary
- The objectives of the step
- The outputs of the step
- The actions necessary to complete the step
- How to complete the actions
- Checklist of tasks to be completed

Part 3: Toolbox / Appendices

A range of templates and criteria tables which may be useful when conducting the emergency risk assessment process.

Toolbox

To assist the ERM process, a "toolbox" to accompany this guide will be available on the Tasmania State Emergency Service website (www.ses.tas.gov.au). The toolbox consists of:

- The Tasmanian Emergency Risk Assessment Guidelines 2017 (this facilitator's guide)
- The Tasmanian Emergency Risk Assessment Quick Guide 2017 (abbreviated version)
- Tasmanian Emergency Risk Register (TERR) Tool – An Excel spreadsheet where you can input your data throughout the ERM process. It will do all necessary calculations, including assigning risk levels
- Tailored Consequence Table – An Excel spreadsheet that will generate a consequence table specific to your community
- Generic Risk Statements Database Tool – A spreadsheet containing risk statements that can be tailored to your suit your community
- Workshop presentation – For use in the workshop environment. The presentation will assist in initiating discussion in the workshop and is supported by facilitator notes for ease of use.

Criteria tables

- Control effectiveness table
- Consequence table
- Likelihood level table
- Risk level matrix
- Confidence level table
- Priority level tables

Templates

- Risk register template
- Project plan template
- Hazard scenario template
- Risk statements template for workshop participants
- Local level risk assessment summary document

Supporting tools

NERAG training – join the Australian Institute for Disaster Resilience (AIDR) to access the NERAG online training course:

http://elearning.aidr.org.au

The Torrens Resilience Institute's Community Resilience scorecard – build a better understanding of the community context by preparing a scorecard before assessment events:

www.flinders.edu.au/fms/documents/NP1314_Revised_TRI%20Toolkit%20and%20Scorecard%20Version%202.pdf

For more detailed planning, consider the resources available from the Tasmanian Government project management website:

www.egovernment.tas.gov.au/project_management/getting_started_in_project_management

For more detailed communication and consultation tools, go to the Tasmanian Government communications website:

www.communications.tas.gov.au/channels/communication_strategy

Risk assessment document outputs

The Tasmanian Emergency Management Plan (TEMP) and SEMC policies require that hazard management authorities and State, Regional and Municipal committees undertake risk-based planning.

Emergency risk management is an ongoing process; therefore communication and consultation among those with responsibilities in emergency management is key to ensuring a safer community. It is important that management authorities with prevention and mitigation responsibilities work closely with Municipal and Regional Committees to undertake risk assessments and identify achievable risk management strategies and treatments. The Municipal Emergency Management Coordinator maintains responsibility for the emergency risk assessment documentation for the Municipal Committee/s while gaining valuable input from other relevant agencies.

To help inform the emergency management committees and hazard management authorities, a "Local Level Risk Assessment Summary Document" is to be completed for all relevant hazards. The document should detail the hazards assessed, the scenarios used for assessment, workshop attendance and identified risks prioritised with preliminary treatment strategy suggestions. A template for this document can be found in the toolbox and is also available for download from the SES website.

CHAPTER 1:

Emergency risk management

CHAPTER 1:

Emergency risk management

While risk is defined by the National Emergency Risk Assessment Guidelines (NERAG) as "the effect of uncertainty on objectives", the UN International Strategy for Disaster Reduction (UNISDR) suggests a more disaster-orientated version as "the combination of the probability of an event and its negative consequences"[4].

Emergency risk management (ERM) is defined as "a systematic process which contributes to the wellbeing of communities and the environment. The process considers the likely effects of hazardous events and the controls by which they can be minimised"[5]. ERM comprises three distinct interacting elements: the risk management principles, the risk management framework and the risk management process (Figure 2), which are outlined in the 2015 NERAG[6].

Applying the ERM principles creates the conditions needed for organisations to conduct effective emergency risk management and outline the manner in which to undertake the emergency risk assessment process. The ERM framework is the "overarching governance arrangement"[7] that is needed to ensure the ERM process occurs and that the results are noted and implemented. A good framework creates the space and support needed to make sure the process can be completed effectively. The ERM process consists of the actions which are undertaken to look at the actual risks facing a community.

Risk management principles

The emergency risk management principles for Tasmania have been embedded in the SEMC draft *Emergency Management Planning Policy*[8].

4 UNISDR – *Terminology on Disaster Risk Reduction.*

5 UNISDR – *Terminology on Disaster Risk Reduction.*

6 *National Emergency Risk Assessment Guidelines – second edition Handbook 10 2014.* Adapted from AS/NZS ISO 31000 – Reproduced under SAI Global copyright Licence 1411-c083.

7 *NERAG*, page 11.

8 www.ses.tas.gov.au

Risk management framework

Applying the risk management framework (Figure 3) allows risk information to be "adequately reported and used in decision making at relevant levels"[9]. It ensures that the appropriate pathways of communication are established and there is a commitment by leadership.

FIGURE 2: RISK MANAGEMENT – PRINCIPLES, FRAMEWORK AND PROCESS

9 *National Emergency Risk Assessment Guidelines – second edition Handbook 10 2014.* Adapted from AS/NZS ISO 31000 – Reproduced under SAI Global copyright Licence 1411-c083.

Mandate and commitment

The mandate for emergency management is outlined in the *Emergency Management Act 2006*[10] (Tas) with particular reference to:

"Emergency management" means –

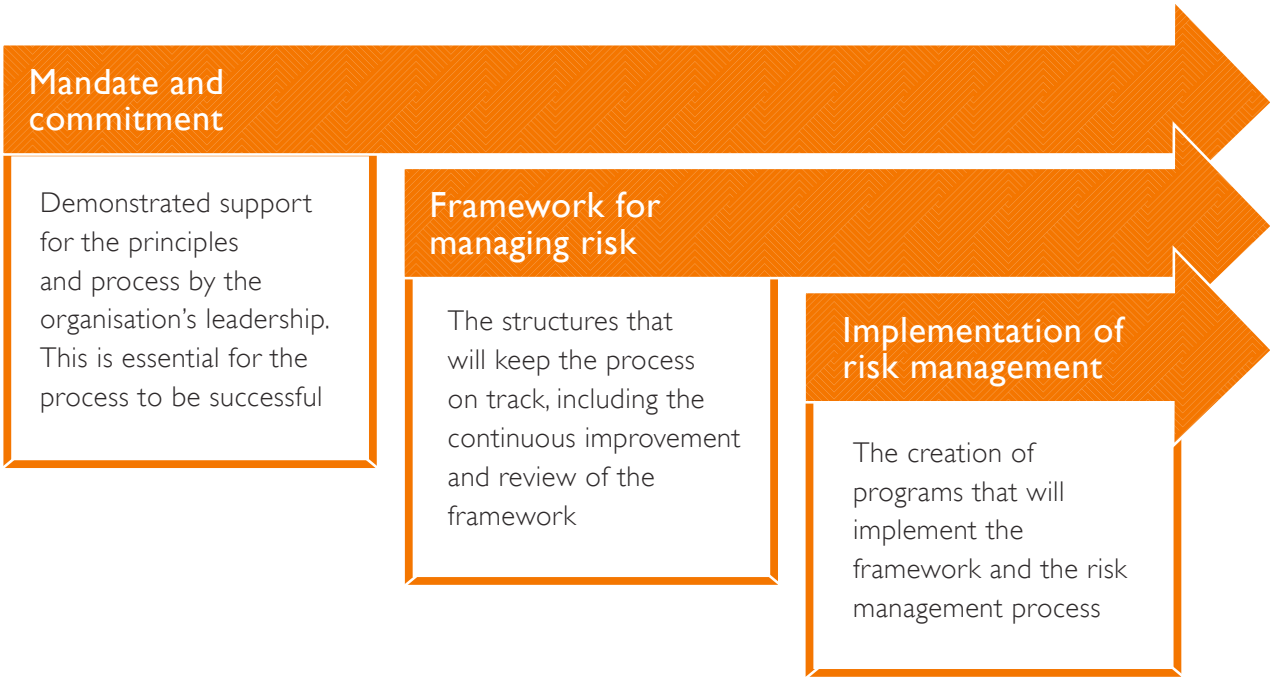
(a) the planning, organisation, coordination and implementation of measures that are necessary or desirable to prevent, mitigate, respond to, overcome and recover from an emergency

(b) …

The commitment to emergency risk management planning for Tasmania is embedded in the SEMC's draft *Emergency Management Planning Policy* and the *Tasmanian Emergency Management Plan* (TEMP).

Organisations in Tasmania's emergency management environment include the committees at State, Regional and Municipal level and the management authorities responsible for Prevention and Mitigation, Preparedness, Response and Recovery for the identified hazards. These responsibilities are captured in the TEMP.

FIGURE 3: RISK MANAGEMENT FRAMEWORK



10 *Emergency Management Act 2006*; Tasmania Part 1-3.

Framework design

The framework design that keeps the process on track includes:

- understanding the context of where the process occurs (e.g. culture of organisations)
- establishing accountability measures
- assigning responsibility for integrating risk management into the organisation
- establishing internal and external communication and reporting lines

Implementation

Risk management actions include all of the current controls that are in place and funded by government, business and industry, and individuals to reduce the consequences that arise from hazard events. These may be prevention, preparedness, response or recovery actions.

When the assessment process identifies gaps in the hazard management system that are outside the risk tolerance, new treatments are identified and a plan to implement them established.

Monitoring, review and improvement cycle

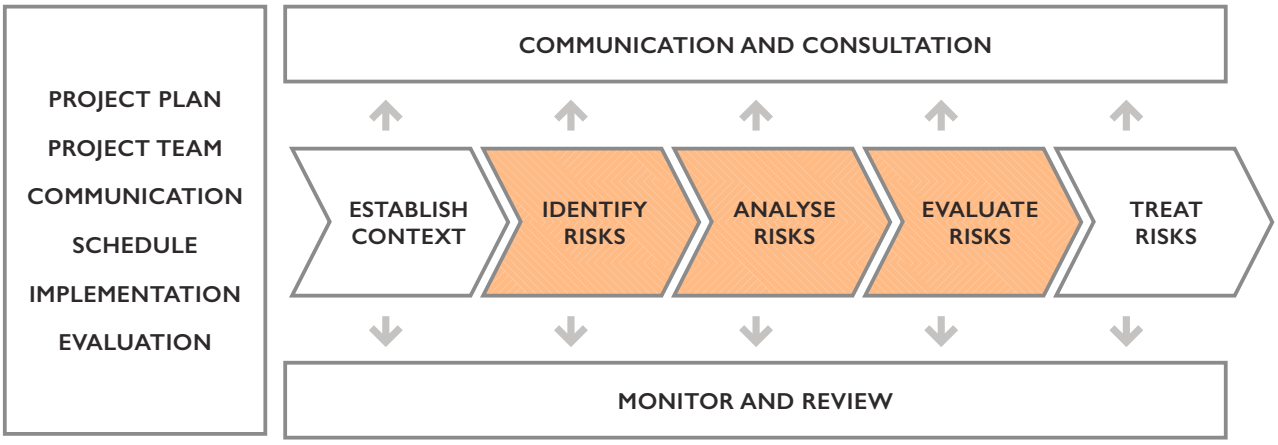
This is to ensure the framework (organisational structures and commitment) and the process are still working and improving over time.

It is unlikely that the nature of each of these components will be discrete as shown here. Existing organisational or administrative measures may aid the process.

Risk management process

The risk management process is a system involving five main phases supported by ongoing communication, consultation, monitoring and review (Figure 4)[11]. Risk assessment is the combined steps of identification, analysis and evaluation of risks.

FIGURE 4: RISK MANAGEMENT PROCESS AFTER ISO 31000



The five main phases are:

1 ESTABLISH THE CONTEXT

Allows stakeholders to agree on the overall objectives and the scope in which they will operate. It defines the community environment and any potential issues that may affect the emergency risk assessment process. In this step, we set all the risk assessment criteria measures.

2 IDENTIFY THE RISKS

Using scenarios to help us, we identify and describe the nature of the hazards, the assets and values that may be impacted by each hazard, and the vulnerabilities of the assets and values to that hazard. These are described as risk statements.

3 ANALYSE THE RISKS

Examines the risk (statements), considering their likelihood and consequence(s) and assigns levels of risk. This provides a consistent measure for each risk statement.

4 EVALUATE THE RISKS

Compares the risks with the set evaluation criteria and decides which risks require treatment and assigns priorities.

5 TREAT THE RISKS

Selects and implements appropriate treatments to deal with risks.

Each step is supported by two activities:

COMMUNICATION CONSULTATION:

Aims to ensure two-way communication with internal and external stakeholders throughout the process.

MONITORING AND REVIEW

Allows for ongoing improvement of the process and maintains confidence in the risk management strategy.

CHAPTER 2:

Risk assessment method – summary

CHAPTER 2:

Risk assessment method – summary

Armed with an understanding of the foundational principles of emergency risk assessment and the necessary support mechanisms for the process to succeed, we can now carry out the emergency risk assessment by following these guidelines and using the tools and templates provided. It is valuable to have participated in the Tasmanian Emergency Risk Assessment training or the online National Emergency Risk Assessment Guidelines (NERAG) training on the Australian Institute of Disaster Resilience website. Committees or management authorities could consider involving an emergency risk assessment facilitator to help them get the best out of the assessment process or review.

There are 29 local governments (at the time of publishing) in Tasmania and three regions, which vary by size, location and resourcing. Each Municipal Emergency Management Committee (MEMC) or group is at a different stage in their emergency risk management process and often has access to limited resources with which to complete it.

Experience conducting risk assessments at the State level and nationally has shown that a facilitated workshop environment, with relevant stakeholders in attendance, is the most effective format for risk assessments. It gives stakeholders the opportunity to openly exchange knowledge and information between the hazard management authority (TEMP table 4), asset and values managers, the community and committee members. Where a broad range of expertise and knowledge is used, a workshop can build a comprehensive and shared understanding of the risks posed to an individual community, economy or environment.

The emergency risk assessment process tasks are therefore explained in this guide in terms of what needs to be done before, during and after the workshop (Figure 5).

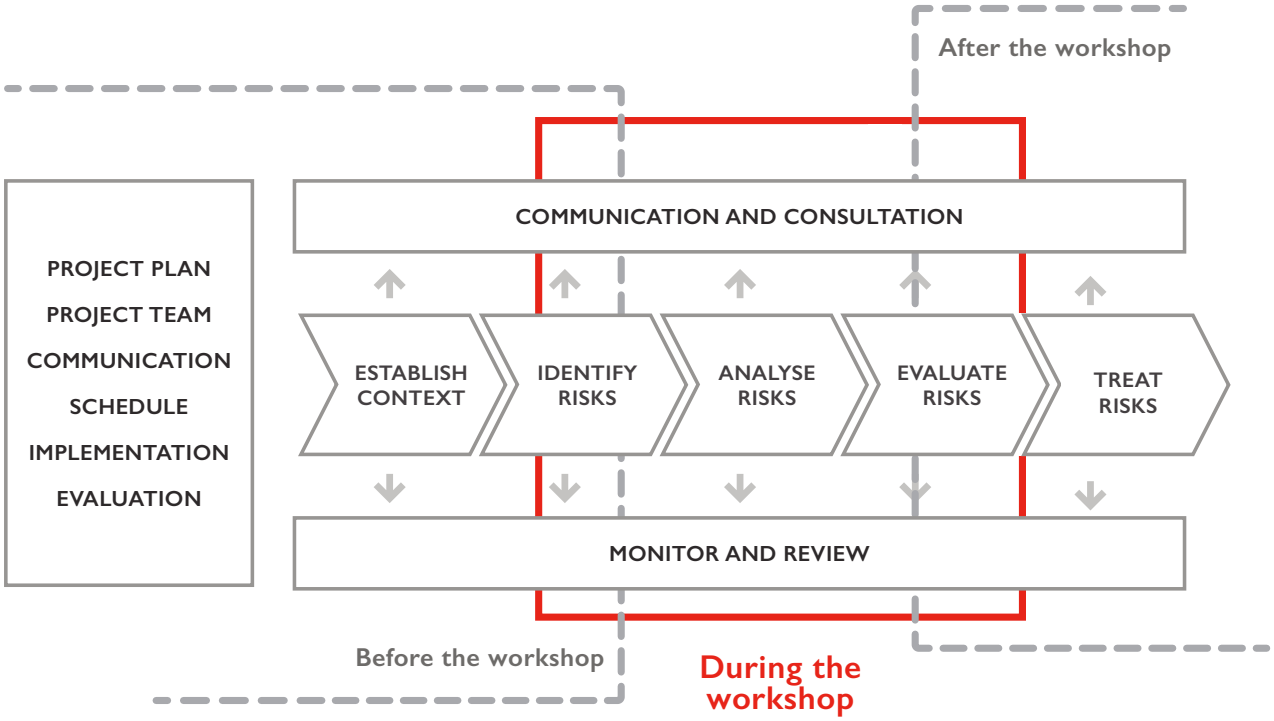
NERAG TRAINING

Join the Australian Institute for Disaster Resilience (AIDR) to access the NERAG online training course:

http://elearning.aidr.org.au

Australian Institute for Disaster Resilience

FIGURE 5: ACTIVITIES BEFORE, DURING AND AFTER THE WORKSHOP



Before the workshop

The key tasks to be undertaken before the workshop are:

Project management *CHAPTERS* 3 4 5

Establish the risk assessment project

The committee or responsible hazard management authority will have set the scope for the risk assessment and should include:

- the risk assessment objectives – is this a new assessment or a review?
- the hazards to be addressed – all or specific
- the location to which this assessment will apply – place / theme
- the vectors and impact types to be considered
- the timeframes for delivery
- any focus areas or constraints

If you haven't been provided a clear scope, check with the assessment initiators.

Assemble a risk assessment team

The team will organise and conduct the emergency risk assessment process. It should consist of two to four people with tasks and responsibilities assigned appropriately (e.g. team leader, facilitator). This team will be conducting all the following tasks.

Plan the project

The team should use a project plan to manage the risk assessment process. A simple draft project outline is included at the SES toolbox. A project plan allows everyone to agree and understand what the scope of the risk assessment is, who is to do what, when and in what order, what any costs may be and who is responsible to pay for them. For more detailed planning, consider the resources available from the Tasmanian Government project management website.

www.egovernment.tas.gov.au/project_management/getting_started_in_project_management

Organise the workshop

There are a number of different tasks to complete before the workshop to ensure it runs smoothly on the day and the focus remains on collecting valuable data. Logistics tasks include sending an agenda prior to the workshop, organising an appropriate venue, arranging catering and facilities, etc. A workshop checklist can be found in the SES toolbox to be used to ensure everything is complete.

For participants there is also the need to develop scenarios and risk statements that may apply to the assessment area as well as gather the evidence that is required for the workshop. Analysis of historic events, maps of exposed areas and existing plans are all useful evidence to bring to the workshop.

Create a communication and consultation plan

Develop a plan that will keep all stakeholders informed of the progress and outcomes. This plan will outline communication and consultation with key experts, workshop participants and executives of Regional and Municipal committees. The communication and consultation plan should reflect the project scope and, if required, provide plenty of time to engage and consult with industry, business, interest groups and the community. A simple communication and consultation guide is available at the SES toolbox. For more detailed communication and consultation tools, go to the Tasmanian Government communications website:

www.communications.tas.gov.au/channels/communication_strategy

Create an evaluation and monitoring plan for the project

Monitoring and review are applied through the risk assessment process. The assessment itself may be an annual review of the existing risk assessment or a new assessment. The project evaluation plan allows the committee and participants to understand how well they have performed the project and to capture important lessons for the future. See the SES toolbox.

Establish the context CHAPTER 6

Identify and engage with key stakeholder group

This is a small group (6-8 people) who have expert knowledge of the chosen hazard(s) and local knowledge of the area being assessed. These experts are important to involve in the context-setting tasks. Stakeholders to consider are those who have legislative responsibility, those that invest in risk management activities and those who may be impacted by a hazard event. Existing committees are good at these tasks.

Establish risk criteria

The risk criteria are made up of the tables and measures used to guide the risk assessment quantification. Criteria that have been established for likelihood measures, control strength and expediency, and confidence level will be consistently applied. Consequence category levels should be reviewed by the project team as to their appropriateness for the assessment area. The state level and a recommended regional scale table are included with the other tables in the toolbox and on the SES website.

Understand the context

The context allows us to understand the values, assets and community characteristics and aspirations of the assessment area.

Each assessment area has its own set of social and cultural values and events, critical infrastructure and essential services, strategic plans for the development of the area, and community demographics. These influence significantly the future consideration of exposure and vulnerability to specific hazards and should be understood through evidence-gathering prior to workshops.

The Torrens Resilience Institute's Community Resilience scorecard[12] helps us build a better understanding of the community context by preparing a scorecard before assessment events:

www.flinders.edu.au/fms/documents/NP1314_Revised_TRI%20Toolkit%20and%20Scorecard%20Version%202.pdf

Identify the risks CHAPTER 7

Determine hazards to be assessed

Consider potential hazards and hazard source(s) to determine most relevant hazards to assess.

Develop scenarios

Key stakeholder group to develop the credible scenarios including a worst-case scenario for chosen hazards. Some hazards occur regularly with medium or moderate impacts that over time accrue impacts on values. A second high-return scenario should be considered for some hazards. A scenario template is provided in the SES toolbox.

12 Torrens Resilience Institute, *A way to measure Community Disaster Resilience. Community Disaster Resilience Scorecard Toolkit*, Version 2 June 2015.

Write risk statements

Key stakeholder group to write risk statements which describe the relationship between hazard, risk and the consequences. These risk statements are placed on the risk register for analysis in the workshop. A database of risk statements is available in the SES toolbox.

Identify current controls for the risks that are in place

The final step to consider is what currently exists to prevent the impacts of such events. These measures are called controls. A list of standard controls for each hazard is included in the toolbox.

During the workshop

During the workshop, it is important to encourage discussion, apply a consistent process and reach evidence-based conclusions. In order to do this, it is essential that all participants have a shared understanding of what is required and expected from the beginning. This can be done at the start of the workshop by:

- explaining the objective of the workshop and the intended outputs
- presenting and explaining the risk criteria and process that will be used to conduct the risk analysis
- presenting the context of the hazards to be assessed
- presenting the credible scenarios that will be used for the risk analysis
- outlining the risk statements/test if there are more
- presenting and highlighting vulnerabilities within the scope of your assessment that may be impacted and what these general impacts may be

It is often beneficial if these presentations are divided between the facilitator and stakeholder, such as the hazard management authority's representative for the hazard being assessed, as they are likely to contribute specialist knowledge. The TEMP contains a list of the hazard management authorities for all 32 prescribed hazards.

The workshop will capture the risk analysis of the scenario-driven risk statements in the risk register. (See the toolbox.)

Analyse the risks CHAPTER 8

Assign a consequence level

In the risk analysis portion of the workshop, participants are asked to collectively assign a consequence level to each of the risk statements that have been generated from the scenarios for each hazard. This consequence level is taken from the consequence table (see the toolbox).

Assign a likelihood level

During the workshop, participants are asked to assign a likelihood level based on the probability of the event occurring and the probability of the consequence occurring. This likelihood level is taken from the likelihood descriptors table. The probability of the consequence occurring reflects the strength and expediency of the existing controls. A schedule of controls and table of control effectiveness measures are provided in the toolbox.

Assign a risk level

With the likelihood and consequence determined, it is possible to assign a risk level by using the risk matrix. The risk matrix is in the toolbox. The matrix is preloaded into the risk register and will automatically generate a risk level based on the likelihood and consequence measures.

Assign a confidence level

This risk analysis will be used to support significant decisions of hazard management authorities, committees and communities. As the analysis considers both qualitative and quantitative information and group decision-making, it is important to assign a confidence level to the results. The confidence level will consider the supporting evidence, level of expertise and participant agreement, which are included in a table in the toolbox.

After the workshop

Dependent on the scale of analysis, it may be possible to undertake evaluation within the workshop. After results have been compiled, the following steps can be completed:

Evaluate the risks *CHAPTER* 9

This step involves assessing the risk analysis results from the workshop. It will be useful to determine if there are common elements at risk (e.g. certain bridges) regardless of the hazard. The evaluation process is carried out to determine if the risks are acceptable, if something could be done to lower the risk and which risks to treat first.

The committee will need to:

- assign a priority to each risk
- determine how to address prioritised risks
- plan further analysis if required
- update the risk register

Treat the risks CHAPTER 10

The purpose of this step is to determine and implement the most appropriate action(s) for risks requiring treatment. The results of the risk assessment and risk evaluation will help to inform risk treatments. Risk treatment strategies should be determined in a collective manner between the hazard managers and committees to:

- identify the treatment options
- evaluate the potential treatment options
- select the appropriate treatments
- establish a treatment plan
- update the risk register

Monitor and review

All stages of the process are subject to regular checks to ensure that information is relevant and up to date and that the most efficient emergency risk management approach is in place. Monitoring and review should be ongoing to account for any changes either in the community environment itself, the adequacy of controls or elements of the risk. The TEMP will outline the review criteria. Committees will need to:

- review the context across the consequence categories
- review the risk components
- monitor and review the risk treatment strategies
- update the risk register

CHAPTER 3:

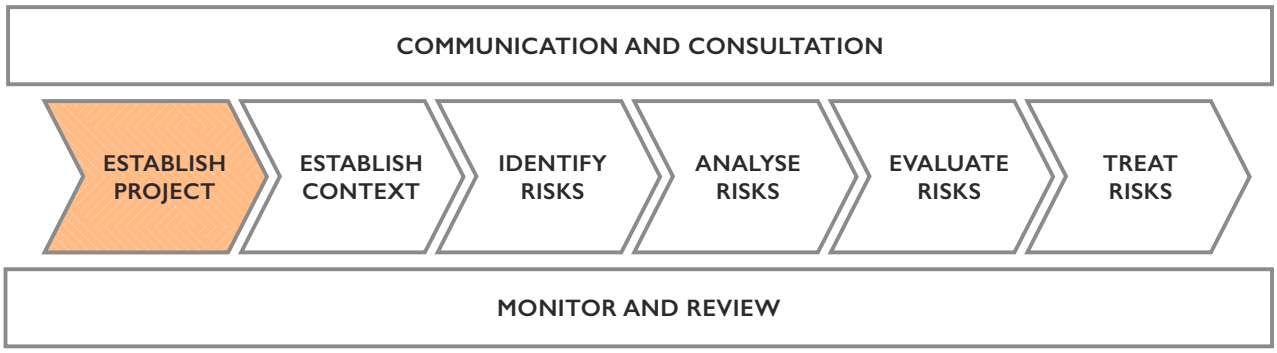
Establish the project

CHAPTER 3:

Establish the project

Establishing the project is the first phase (Figure 6) and is fundamental to allow stakeholders to agree on a common understanding of objectives and how they will be achieved. The team should use a project plan to manage the risk assessment process. A simple draft project outline is included at the SES toolbox. A project plan allows everyone to agree and understand what the scope of the risk assessment is, who is to do what and when and in what order, what any costs may be and who is responsible to pay for them.

FIGURE 6: ERM PROCESS – ESTABLISH THE PROJECT



Objective

To agree on a common understanding of the aims and process of the emergency risk assessment process, to ensure that all relevant risks are considered.

Output

- **A mutual agreement about the scope of the project**
- **An established, mutually agreed project plan, incorporating communication and evaluation**

Actions

(1) **Establish the project team**
(2) **Identify all stakeholders**
(3) **Develop a shared understanding of the project scope**
(4) **Develop a project plan**

ACTION 1: Establish the project team

The team will organise and conduct the emergency risk assessment process. It should consist of two to four people with tasks and responsibilities assigned appropriately (e.g. team leader, facilitator). This team will be conducting all the following tasks.

ACTION 2: Identify all stakeholders

Stakeholders should be identified by the risk assessment team before the workshop. They can be categorised into one of four groups:

- those who may be affected by the impacts from an emergency event
- those who may contribute specialist knowledge to the process
- those who have jurisdictional authority for the specific hazards and/or elements at risk
- those who invest in risk controls or treatments

ACTION 3: Develop a shared understanding of the project scope

The committee or responsible hazard management authority will have set the scope for the risk assessment and should include:

- the risk assessment objectives
- the hazards to be addressed – all or specific
- the location to which this assessment will apply – place / theme
- the vectors and impact types to be considered
- the timeframes for delivery
- any focus areas or constraints

If you haven't been provided a clear scope, check with the assessment initiators.

ACTION 4: Develop a project plan

A project plan, including the communication and evaluation plan, is helpful to assist the risk assessment team in structuring their work and ensuring that all necessary points are covered. This plan should be submitted to the key stakeholder group for comment. An example of a project plan is provided in the SES toolbox.

For more detailed planning, consider the resources available from the Tasmanian Government project management website.

www.egovernment.tas.gov.au/project_management/getting_started_in_project_management

Continuous communication is vital in producing a robust project plan, and the project plan will be refined as you progress. Develop a communication strategy that will keep all stakeholders informed of the progress and outcomes. This plan will outline communication and consultation with key experts, workshop participants and executives of Regional and Municipal committees. The communication and consultation plan (Chapter 4) should reflect the project scope and if required, provide plenty of time to engage and consult with industry, business, interest groups and the community.

There are a number of different tasks to complete before the workshop to ensure it runs smoothly on the day and the focus remains on collecting valuable data. These tasks include sending an agenda prior to the workshop, organising an appropriate venue, arranging catering and facilities, etc. A workshop checklist can be found in the SES toolbox to be used to ensure everything is complete. When you are preparing for your workshop, don't forget to update your plan to include:

- ✓ a realistic schedule for the risk assessment workshop;
- ✓ necessary resources required to run the workshop (consider the room, projector, workshop materials); and
- ✓ an agenda, to be provided to all stakeholders beforehand.

The project evaluation plan allows the committee and participants to understand how well they have performed the project and to capture important lessons for the future. See the SES toolbox.

Establish the project checklist

You should have completed the following 'Establish the project' tasks before moving on:

- ✓ Assemble a risk assessment team and assign a team leader and/or facilitator to run the workshop.
- ✓ Develop a mutually agreed project plan, incorporating communication and evaluation strategies.

CHAPTER 4:

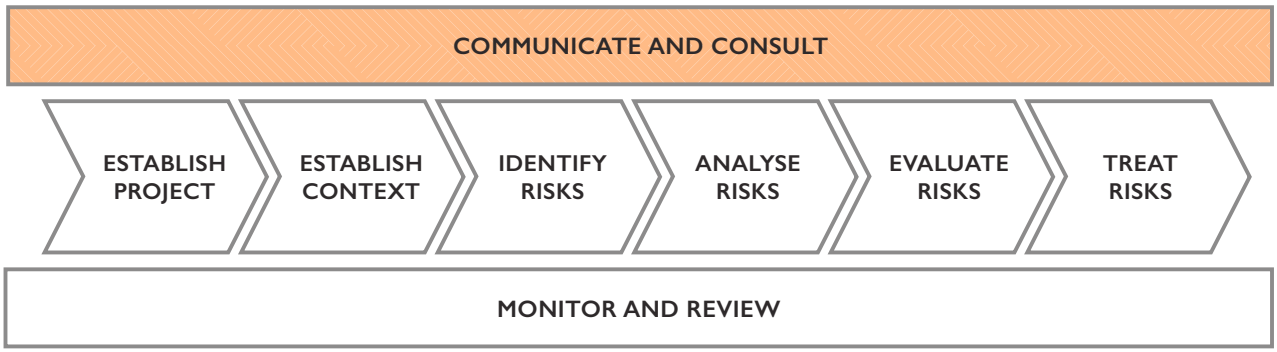
Communicate and consult

CHAPTER 4:

Communicate and consult

Communication and consultation are fundamental throughout the ERM process (Figure 7), and should be ongoing with both internal and external stakeholders. It is vital to ensure that all those involved are kept well informed, and invited to contribute during every stage of the process.

FIGURE 7: ERM PROCESS – COMMUNICATE AND CONSULT



Relationship-building and communication with stakeholders, identified in Chapter 3, should start before any formal start of the risk assessment process. Plans for communication and consultation should be developed at an early stage and should address any communication risks, the source of those risks, the consequences and the measures being taken to address them. A simple communication and consultation guide example is shown at Table 3. For more detailed communication and consultation tools, go to the Tasmanian Government communications website:

www.communications.tas.gov.au/channels/communication_strategy

At all times, ensure that communication remains clear and unambiguous. It is critical to ensure that stakeholders understand the basis on which decisions are made and the reasons why particular actions are necessary. Stakeholders' views on risk may differ depending on their values, needs, assumptions and concerns. Differences in perception should be identified, recorded and addressed early in the process.

Objective

To ensure effective communication and consultation throughout the ERM process.

Output

- **An established plan detailing method(s) of ongoing communication that keeps all stakeholders informed**
- **A transparent process whereby information and views can continually be exchanged**
- **Stakeholders actively involved in decision-making**

Actions

(1) **Identify all key stakeholders, including internal and external participants involved in the ERM process.**

(2) **Establish an agreed plan detailing the method(s) of ongoing communication and consultation.**

(3) **Implement the plan and where necessary make adjustments based on feedback.**

ACTION 1: Identify all key stakeholders, including internal and external participants involved in the ERM process

The effectiveness of the emergency risk assessment process is dependent on getting the right stakeholders participating in the workshop. Consequently, it is important to communicate with stakeholders as early as possible to ensure they can participate. A lack of key representation from a particular organisation can result in a particular risk not being able to be assessed or being assessed poorly.

Stakeholders should be identified by the risk assessment team before the workshop. They can be categorised into one of four groups:

- those who may be affected by the impacts from an emergency event
- those who may contribute specialist knowledge to the process
- those who have jurisdictional authority for the specific hazards and/or elements at risk
- those who invest in risk controls or treatments

Stakeholders that you may consider inviting to the risk assessment workshop should go beyond your committee membership and could include:

- hazard management authorities – listed in the TEMP
- critical infrastructure and essential services owners and managers
- establishments that house vulnerable persons – education, care, hospitals, corrections
- event managers – for major local events
- industry and business representatives – drivers of local economy
- government departments – with business in your area
- community representatives – elected officials, volunteer and community groups, remote or isolated

ACTION 2: Establish an agreed plan detailing the method(s) of ongoing communication and consultation

The process of communication and consultation should consider:

- the type of information you are communicating
- the presentation of information, ensuring it is user-friendly and engaging
- the audience receiving the information: it may be necessary to present messages in different ways for different groups of people

What is the appropriate level of consultation that is being undertaken? The Department of Premier and Cabinet promotes this International Association of Public Participation (IAP2) aligned approach (Table 2). The spectrum of community engagement provides guidance as to the goal that is sought and the promise that is made in adopting a particular approach from the spectrum. The level of public impact increases from "inform" through to "empower".

TABLE 2: COMMUNITY ENGAGEMENT SPECTRUM BASED ON THE INTERNATIONAL ASSOCIATION OF PUBLIC PARTICIPATION 'SPECTRUM OF COMMUNITY ENGAGEMENT'

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Goal	To provide balanced and objective information in a timely manner	To obtain feedback on issues, priorities and decisions	To work with communities to ensure concerns and aspirations are considered and understood	To partner with the public in each aspect of the decision-making	To place final decision-making in the hands of the public
Promise	"We will keep you informed"	"We will listen and acknowledge your concerns"	"We will work with you to ensure your concerns and aspirations are directly reflected in the decisions made"	"We will look to you for advice and innovation and incorporate this in decisions as much as possible "	"We will (help you) implement what you decide"

TABLE 3: EXAMPLE OF SIMPLE COMMUNICATION AND CONSULTATION PLAN

Key stakeholder	Method of communication	Timescale	Purpose
Key stakeholders involved in developing workshop	Meeting	Start of process	To discuss the risk assessment process and establish tasks and responsibilities
	Meeting	2 months before workshop	To develop hazard scenarios
Risk assessment team	Email	Weekly	To keep team updated
	Meetings	1 to 2 weeks or as necessary	To ensure tasks are completed as appropriate
Workshop participants	Letter	1 month before workshop	Invite participants
	Email	1 week before workshop	Confirmation and reminder
	Workshop	1 month after initial communication	Risk assessment workshop

ACTION 3: Implement the plan and where necessary make adjustments based on feedback

When implementing the plan, remember to continuously update and review it in line with the communication objective and the engagement promise.

Communicate and consult checklist

You should have completed the following 'Communication and consultation' tasks before moving on:

- ✓ Establish an agreed communication and consultation plan detailing the method(s) of ongoing internal and external communication and consultation.
- ✓ Implement the communication and consultation plan and where necessary make adjustments based on feedback.

CHAPTER 5:

Monitor and review

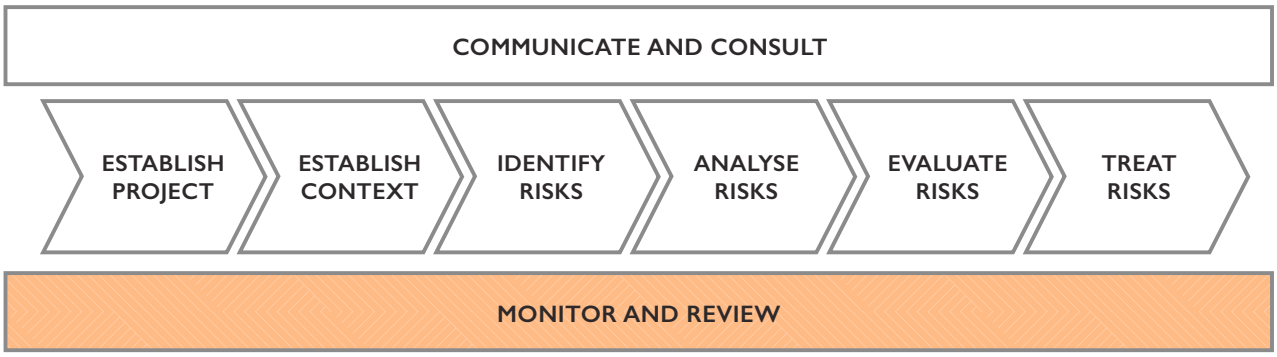
CHAPTER 5:

Monitor and review

Rarely will a disaster risk management program start with a blank sheet, as a wide range of controls are already in place. Some of these may have been based on previous formal risk assessments, or they may have evolved from opportunities as they are identified. However, this risk assessment may be the first time the effectiveness of these controls are considered against the specific hazards scenarios that may be possible for the assessment area.

An essential component of emergency risk management is to establish continuous monitoring and review (Figure 8) of the risk(s) in order to evaluate the ongoing effectiveness of existing controls, and account for any change in circumstance. All stages of the process are subject to regular checks to ensure that information is relevant, up-to-date, and the most efficient ERM approach is in place.

FIGURE 8: ERM PROCESS – MONITOR AND REVIEW



The SEMC draft *Emergency Management Planning Policy* outlines risk review timeframes. A yearly review is recommended to capture any significant changes in the community environment and track how treatment strategies are progressing. A substantial review that reassesses the risk should be done every five years.

The approach for a risk review is shown here.

Objective

To ensure that the ERM process, the risk register and the treatment plan remain current and valid; and that any change in circumstance is accounted for.

Output

- **Principles and practice of the ERM process are up-to-date**
- **Confirmation that the most appropriate treatment options are in place and effective**
- **Updated risk register**

Actions

(1) **Review the context**
(2) **Review the risks – consider changes in the hazard, exposure and vulnerability**
(3) **Monitor and review risk treatment strategies**
(4) **Record all results and modifications**

ACTION 1: Review the context

Identify any changes in circumstance that may change any part of the community environment, the scope, or the risk management framework (Chapter 2). Consider changes in the five key areas (Chapter 6), regardless of how significant these may be. Priorities and perceptions of risk by the community do change over time.

Examples of change are illustrated in Table 4; however please note that these examples are just a select number of the many factors that must be considered when re-evaluating the community environment context.

TABLE 4: ABRIDGED EXAMPLES OF CHANGE IN THE COMMUNITY ENVIRONMENT CONTEXT

KEY AREA	EXAMPLES OF CHANGE
People	A change in the population
Economy	A change in the current state of the local economy, such as a change in predominant industry
Environment	Changes in conservation areas, sensitive areas etc.
Social setting	Changes in the resilience of the community
Public administration	Changes in in the capability of the current governing body

ACTION 2: Review the risks

Having accounted for any changes to the community environment context, it is necessary to re-evaluate changes in the hazard(s). This should consider changes in:

- the frequency of the hazard
- the scale of the hazard
- the likelihood of the hazard
- the exposure to the hazard
- the vulnerability of the five key areas to the hazard

This may mean re-visiting the risk identification, analysis and evaluation phases of the ERM process. You will need to:

- ensure that current, relevant information is used in order to identify likelihood, consequence and confidence levels
- consider information gathered from emergency events that may have occurred since the previous review

ACTION 3: Monitor and review risk treatment strategies

It is essential to continuously monitor and review the current agreed controls and risk treatments as to how effective they are. In addition, it is important to ensure that identified controls are operating efficiently and achieving the assumed improvements, through any changes that may have occurred or are anticipated to.

Remember: Any identified changes in circumstance may impact risk treatment decisions. Therefore if risk identification, analysis and/or evaluation are revisited, risk treatment may also need to be modified.

ACTION 4: Record all results and modifications

Regular reports should be generated, and distributed to stakeholders, on the status and progress of the emergency risk management process. These reports should contain critical information such as any change in circumstance and/or any modifications in risk identification, analysis, evaluation and/or treatment. Record recommendations for improvement or changes to the ERM process. The risk register or the TRR Tool should be updated with any changes.

CHAPTER 6:

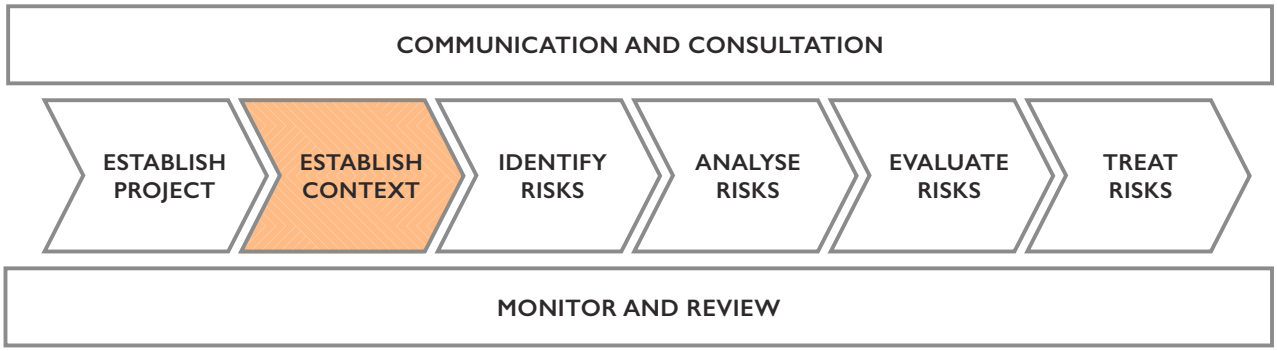
Establish the context

CHAPTER 6:

Establish the context

Having decided how to manage the risk assessment process through project planning, establishing the context becomes the first phase of the risk assessment (Figure 9).

FIGURE 9: ERM PROCESS – ESTABLISH THE CONTEXT



Context setting is the act of defining the risk criteria that will be used for the assessment, and the gathering of information and knowledge that describes the community, social, economic and environmental attributes of the study area.

When establishing risk criteria, this guide uses scalable consequence descriptions for the people and economy impact areas to ensure the level of risk of an event can be assessed at the appropriate scale. For example, a reduction of $2 billion in economic activity from an emergency event could be considered:

- a 'catastrophic' consequence for a local area
- a 'major' consequence for a region
- a 'moderate' consequence for the state

In some cases, where there are small populations or economic value, different consequence categories may have the same criteria. For example, for a population of 15,000, the scaled people criteria for the 'minor', 'moderate' and 'major' consequence categories would all be 'at least 1 death' because values are rounded up to the nearest whole number. In such cases, the highest consequence level should be applied, i.e. major in this example.

Objective

- **To develop a common understanding of the environments in which the emergency risk assessment process takes place.**
- **To adopt a set of risk measurement criteria suitable for the environments being considered.**

Output

- **A mutual agreement about the risk assessment context**
- **A set of risk criteria tables valid for the assessment context**

Actions

(1) **Establish risk criteria**
(2) **Establish the community context**

ACTION 1: Establish risk criteria

Risk criteria assist in making judgements about which risks need to be treated. The criteria should reflect community viewpoints and common values, and consider social and environmental factors. Risk criteria should be agreed on at this point so they are not influenced by outcomes from later phases.

The chosen risk criteria in Tasmania are based on the NERAG 2015, which were adapted to the Tasmanian context during the development of the 2016 Tasmanian State Natural Disaster Risk Assessment. More information about risk criteria is provided in Chapter 7.

The risk criteria are made up of the tables and measures used to guide the risk assessment quantification. Criteria have been established for:

- control strength and expediency
- likelihood measures
- confidence level

These tables and measures are contained in the toolbox and are to be consistently applied.

Consequence category scale levels should be reviewed by the project team as to their appropriateness for the assessment area. Table 5 outlines the consequence measures that are prepared for the different community settings. The state level and a recommended regional scale table are available in the toolbox and on the SES website.

TABLE 5: CONSEQUENCE CATEGORY SCALE SETTINGS

COMMUNITY SETTING	CONSEQUENCE MEASURES
People	Level of death or injury
Economic	General $ losses or industry sector $ impact
Environmental	Species and ecosystem impacts, or natural values impacts
Social setting	Community wellbeing disruption; loss of cultural artefacts or cultural events
Public administration	The decreased capacity of governing bodies or institutions to deliver services

ACTION 2: Establish the community context

It is important to understand the values, assets and community characteristics and aspirations of the assessment area. These are often expressed as social, environmental or economic objectives within broader local policies and plans. To support this, it is useful to identify and engage with a key stakeholder group for the area. This is a small group (6-8 people) who have expert knowledge of the chosen hazard(s) and local knowledge of the area being assessed. These are important to involve in the context setting tasks. Stakeholders to consider are those who have legislative responsibility, those that invest in risk management activities and those who may be impacted by a hazard event. Existing committees are good at this task.

Each assessment area has its own set of social and cultural values and events, critical infrastructure and essential services, strategic development plan and community demographics. These influence significantly the future consideration of exposure and vulnerability to specific hazards and should be understood through evidence-gathering prior to workshops. Further to this, it is valuable to have some sense of community resilience of the assessment area. Undertaking the Torrens Resilience Institute community resilience scorecard before the assessment will help this resilience understanding:

www.flinders.edu.au/fms/documents/NP1314_Revised_TRI%20Toolkit%20and%20Scorecard%2Version%202.pdf

The scope of the risk assessment should address the defined objectives and should consider internal and external parameters.

The internal parameters could include:

- governance and organisational structures
- relevant policies and objectives
- capability of resources and knowledge
- project timeline
- information systems
- relationships with internal stakeholders
- standards, guidelines and models used by the organisations
- existing contractual relationships, where applicable

The external parameters (referring to the local government area or area being assessed) could include our understanding of the objectives for, extent of and/or trends for:

- cultural environment
- social environment
- political environment
- legal and regulatory environment
- jurisdictional boundaries
- geographic data of the area
- technological environment
  (e.g. availability of telecommunication systems)
- economic environment

Where possible, it is valuable to present this context information from existing reliable sources in mapped or tabular form.

The LIST (Land Information System Tasmania) mapping system of the Tasmanian Government contains substantial data to support the context settings. Government departments and in particular local government will have a good understanding and plans for these elements.

Establish the context checklist

You should have completed the following 'Establish the context' tasks before moving on:

- ✓ Identify current and/or prospective community aspects, values and assets that may affect the emergency risk assessment process.
- ✓ Agree on risk assessment criteria tables that are valid for your assessment level.

CHAPTER 7:

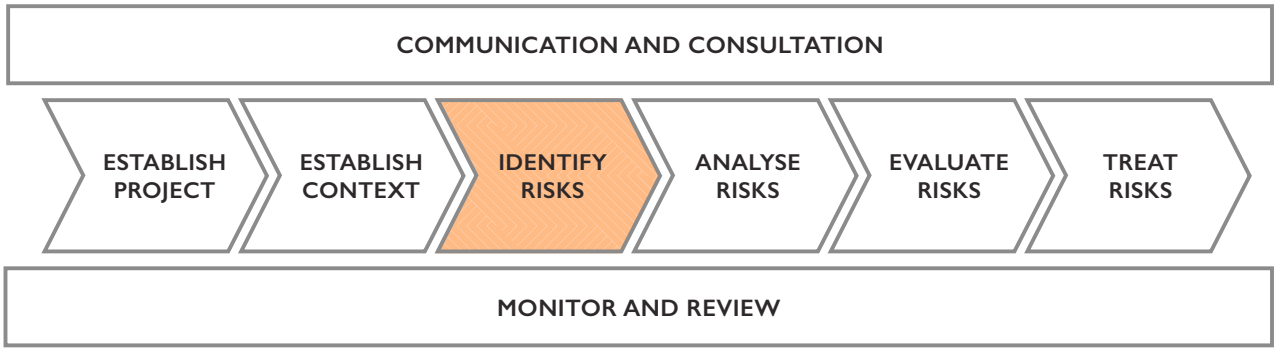
Identify the risks

CHAPTER 7:

Identify the risks

The aim here is to generate a comprehensive list of risks based on the sources of risk (hazard) and their potential consequences (Figure 10). Risk occurs where the hazard (e.g. bushfire, vehicle crash) impacts vulnerable elements of the community, creating an emergency event.

FIGURE 10: ERM PROCESS – IDENTIFY THE RISKS



In this chapter you will identify risk by:

- describing in detail the hazards that could affect your area of assessment
- identifying elements of the community that are exposed and vulnerable to those hazards
- analysing how these two combine as risk to community objectives

It is important to consider both existing as well as new, emerging or potential risks that may come as your community (or local government area) grows.

Risk register

The risk register is the record of all risks your community may face and is the output of the risk assessment process. The register contains all information regarding risk identification and analysis and describes which risks require the most critical attention.

In the toolbox, the risk register is provided in two formats for you to choose between:

- a printable risk register template
- an Excel spreadsheet version – referred to as the Tasmanian Emergency Risk Register Tool (TERR Tool)

Only one risk register is required for your risk assessment. We highly recommend that you use the Excel version.

At the completion of the risk assessment process, the risk register should include the following:

- Risk statements linking the risk source, hazard, impact area and consequences (Chapter 7)
- Existing controls effectiveness (Chapter 8)
- Consequence level (Chapter 8)
- Likelihood level (Chapter 8)
- Risk level (Chapter 8)
- Confidence level (Chapter 8)
- Risk priority (Chapter 9)
- Risk strategy (Chapter 10)
- Action options (Chapter 10)

A complete example of a risk register is shown as an appendix and partial examples are included throughout this guide.

Objective

To develop a systematic and comprehensive table of existing and potential risks.

Output

- **A comprehensive list of all potential risks to community objectives including key details of the risk(s)**
- **Credible hazard scenarios, including worst-case**
- **Risk statements for each relevant hazard**
- **A partially filled risk register with the risk sources, hazards, impact areas, risk statements**
- **A schedule of current controls**

Actions

(1) **Identify and describe the hazard(s) and its source(s)**
(2) **Identify potential exposure and vulnerability to the hazard**
(3) **Develop hazard scenario(s)**
(4) **Write risk statements for each hazard and impact area**
(5) **Identify existing controls**

Identifying risks must be ongoing, comprehensive and systematic to ensure all risks are considered. In addition, it should involve open inclusion of stakeholders and a pool of expertise in order to share a holistic understanding of risk(s).

ACTION 1: Identify and describe the hazard(s) and its source(s)

Describe all hazards that could affect the community using all available sources of information. Use the list of prescribed hazards from the TEMP (Table 4) that the State faces to help you identify which of these hazards may affect your community. This approach should be systematic and comprehensive, so as to not exclude any relevant hazards.

Potential sources of information include:

- historical records (including media, past insurance claims, etc.)
- physical inspection of hazardous sites
- research
- interviews
- brainstorming
- local experience
- existing statistics
- surveys and questionnaires
- common knowledge (local oral history)
- scientific analysis, if available
- previous risk assessments, if available

Carefully consider the source of the hazard and the vector of transference as there may be multiple sources for one hazard or multiple hazards from one source. For example, severe storms may result in hail damage, flash flooding and/or landslide(s). Recently the Tasmanian State Natural Disaster Risk Assessment analysed nine hazards including the health orientated Pandemic Influenza and Heatwave. They are:

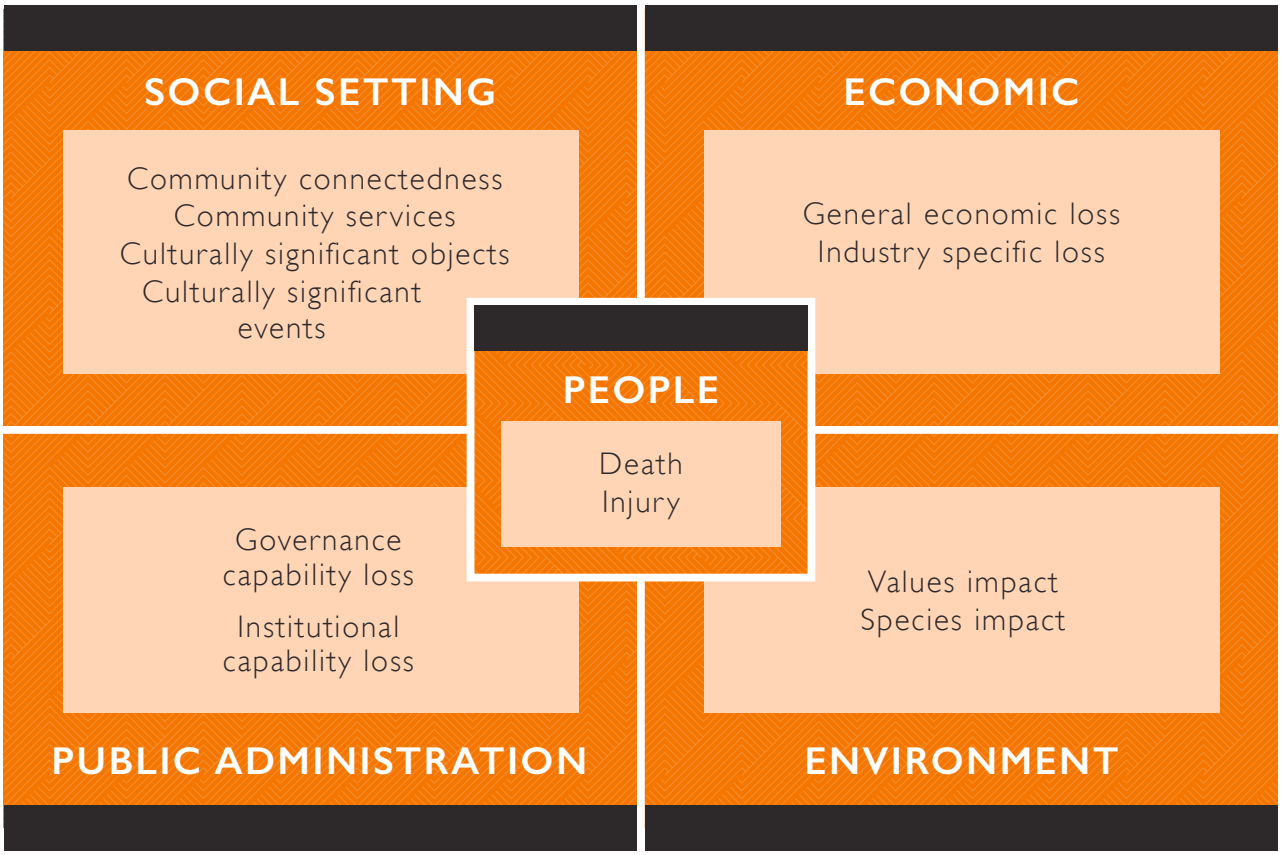
1. Bushfire
2. Flood
3. Heatwave
4. Earthquake
5. Coastal Inundation
6. Severe Storm
7. Landslide
8. Tsunami
9. Pandemic Influenza

ACTION 2: Identify potential exposure and vulnerability to the hazard

The aim of this action is to determine critical elements that, if damaged, would have a significant impact on the community. For example, the loss of the hospital or major power station would significantly impact the community, not just individuals. These critical vulnerable elements and how they may be impacted by the hazard will inform what the scenarios may be for the community. The exposure may be direct or indirect and have a tangible or intangible effect.

For all identified hazards, consider who or what is exposed to them. The community environment can be divided into five key impact areas, or community settings (Figure 11).

FIGURE 11: THE FIVE KEY IMPACT AREAS OR COMMUNITY SETTINGS



In this figure, we have classified the potential impacts to the community as:

1. PEOPLE

1.1 People – Death: The number of deaths expected as a direct consequence of the hazard.

1.2 People – Injury: The number of injuries or illnesses expected as a direct consequence of the hazard.

2. ECONOMIC

2.1 Economic – General: The loss in economic activity and/or asset value as a direct consequence of the hazard.

2.2 Economic – Industry: The economic impact on important industries to the State as a direct consequence of the hazard.

3. ENVIRONMENTAL

3.1 Environment – Species: The loss of ecosystems or species from a region as a direct consequence of the hazard.

3.2 Environment – Values: The loss of environmental values of interest as a direct consequence of the hazard.

4. PUBLIC ADMINISTRATION

4.1 Public Administration: The decreased capacity of governing bodies to deliver core functions as a direct consequence of the hazard.

4.2 Public Administration: The decreased capacity of institutions to deliver core functions, including essential services, as a direct consequence of the hazard.

5. SOCIAL SETTING

5.1 Social – Community Connectedness: The decreased capacity of a community to function as normal without the need for alternative arrangements as a direct consequence of the hazard.

5.2 Social – Community Services. Availability of community support services

5.2 Social – Cultural Significance: The loss of culturally significant objects.

5.3 Social – Cultural Significance: The loss, or interruption, of cultural events as a direct consequence of the hazard.

When considering what could be impacted in the future scenario, think of the following aspects:

- community elements that are exposed to the hazard (e.g. coastal housing);
- community elements that are exposed to the hazard: how may they be impacted by that hazard?;
- community characteristics that influence the scale of the hazard impacts (e.g. low socio-economic demographic); and
- how different community elements will be exposed to different hazards

ACTION 3: Develop hazard scenarios

Using the hazard and vulnerable elements information, a credible worst-case scenario should be developed for each identified hazard. A scenario example is shown in Table 7. Assessors should also consider a graduation of scenarios, as different scale of hazard may have alternative risk reduction strategies. These scenarios will be used to assess the likelihoods and consequence of the risks during the workshop (Chapter 8). While there are in fact a multitude of events that could occur, a scenario is used to assess the risks because it keeps everyone focused on the same event. At minimum, a credible worst-case scenario has been chosen as the scenario to use because if planning and risk reduction activities are done for the largest event, it is more than likely they will address smaller events, even if those are more frequent. It is also valuable at the local scale to consider intermediate scenarios that sit outside the risk tolerance of the community.

Scenarios should be developed in conjunction with experts and stakeholders in the area that have an understanding of the hazard(s) and community objectives, values, exposures and vulnerabilities. Individuals representing the hazard management authority, critical infrastructure providers, health services and local government can be helpful. Scenarios can be created using data from historical events, from previous experiences and/or simulated events based on modelling. This will produce the most credible scenario. The scenario should include a high level of detail about the event characteristics, e.g. fuel loading, weather conditions, type of vehicles involved, after-shock sequence. A separate hazard scenario-planning workshop can be held to develop the scenario and who is responsible for each aspect of it. This should be incorporated in your project planning.

Key aspects of the scenario

A credible worst-case scenario for the hazard in the area of interest (consider historical events and previous experience) is one that:

- requires a multi-agency response
- falls within the consequence table categories (Table 13)
- has a credible Annual Exceedance Probability (AEP) (Table 8)[13]

In addition to the key aspects, there are a few helpful things to have in mind. A good starting point in developing the scenario is to imagine a situation that makes people scared. Often there have been close calls in the past, or statements such as "If it had gone that way, it would have been all over." Another useful tip is to use the consequence table (Table 13) tailored to your population and gross "area" product and aim to produce an event that may have catastrophic impacts across a few (or all) of the five impact areas. These are the types of scenarios you want to consider.

The sample hazard scenarios will be made available on the SES website, which can be modified to suit your area of interest.

The outputs from this action should be:

- a detailed description of the hazard scenario
- creation of a scenario presentation to be given to the workshop participants (Chapter 8)
- if possible, maps showing the hazard extent and intensity to aid workshop participants' understanding of the scenario

A blank scenario template is included in the SES toolbox.

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13 *National Emergency Risk Assessment Guidelines – second edition Handbook 10 2014.*
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TABLE 7: ASPECTS REQUIRED FOR HAZARD SCENARIO DEVELOPMENT WITH TWO FICTIONAL SCENARIOS AS EXAMPLES

REQUIRED ELEMENT	HAZARD SCENARIO EXAMPLE 1	HAZARD SCENARIO EXAMPLE 2
Hazard	**Fire**	**Rail crash**
AEP	0.02 (1 in 50 year)	0.039 (1 in 25 years)
Source	Dry lightning	Derailment and crash into highway bridge
Magnitude	Intense lightning	One goods train
Extent	Whole area of interest (see scenario map)	200 metres of the railway line and the highway bridge
Hazard duration	3-4 days minimum burn time	>24 hours
Location(s)	Whole area of interest (see scenario map)	Crash at crossing of railway line and highway (road above rail)
Time of day/year	Mid-late December	Sunday evening in June
Timeline of events	Midday ignition. Strong winds in afternoon moving fire towards town	Goods train derails in the evening, with emergency response overnight and into the morning. Train removed after 24-48 hours
Characteristics	· Fire danger extreme to catastrophic · NE winds move to NW up to 40km/h · Summer conditions with little rain	Train derails under highway bridge and hits bridge pylons
Anticipated high level impacts		
Death/injuries	Potential for isolated cases of death and injuries from defending, evacuations and smoke inhalation	Potential for a number of injuries and deaths
Infrastructure affected	Potential for main highways and railways to be closed and damage to some essential industries	Potential for railway and highway closure
Additional comments/description		
	· Areas inaccessible, increasing the burn time · Large forested areas are burnt · No reticulated water · Significant outside resources required	· Rail service provides essential supply for paper mill · Issues with isolation – emergency services would take time to get there · Knock-on effects with other users and exporting due to rail and road closures/damage

Determining the event/scenario probability

A key aspect of developing a scenario and assessing risk is determining the probability of the scenario occurring. For example, bushfires occur every year, but how often does one of this scale occur?

In order to be able to compare the risks of different hazards properly, the probability of the event(s) needs to be known. For instance, an earthquake may be very damaging but unlikely to occur very often (1 in 200 years). On the other hand, a serious bushfire may occur more often (1 in 30 years). To properly compare the risks (which is influenced by the probability of the event), the probability of each scenario needs to be determined.

If looking at more than one scenario (e.g. flood and bushfire), you will need an Annual Exceedance Probability, that is the probability of the scenario occurring in a given year, for each. Also remember to consider how often a scenario of that magnitude happens (e.g. not just any bushfire or flood).

Another way to look at scenario probability is the Average Recurrence Interval (ARI). The ARI is a statistical estimate of the average period of time (usually in years) between the occurrences of scenarios of a given size. It is more likely that people can estimate the probability in terms of years; for example, a flood occurs every 40 to 50 years (Table 8).

TABLE 8: COMPARISON OF EQUAL LIKELIHOOD MEASURES

LIKELIHOOD LEVEL	ANNUAL EXCEEDANCE PROBABILITY IN % (AEP)	AVERAGE RECURRENCE INTERVAL (ARI) (INDICATIVE)	FREQUENCY (INDICATIVE)
Almost Certain	63% per year or more	1 year or less	Once or more per year
Likely	10 - <63% per year	1-10 years	Once per 10 years
Unlikely	1 - <10% per year	11-100 years	Once per 100 years
Rare	0.1 - <1% per year	101-1000 years	Once per 1000 years
Very Rare	0.01 - <0.1% per year	1001-10,000 years	Once per 10,000 years
Extremely Rare	<0.01% per year	10,001 years or more	Once per 100,000 years

ACTION 4: Write risk statements

Having identified the hazards (Action 1), vulnerable elements (Action 2) and developed a scenario (Action 3), these components are combined to identify the risks in your community. For each hazard and impact area, record any and all possible consequences for that area, for the given scenario. This can be done by writing risk statements. There is a risk statement database in the SES toolbox available on the SES website which gives generic risk statements that can be modified to suit the impacted area.

Risk statements are single sentences that detail the relationship between the source(s) of risk, the impacted area(s) and the consequences for the given scenario. Risk statements should be written for each hazard and impact category. There should be as many statements as necessary to cover all the possible consequences. Table 9 shows some of the different aspects in the five impact areas that might be impacted.

When writing risk statements, each statement should outline:

- the source of risk
- the emergency event that emerges from the source of risk
- the impact area
- consequences that may result from the source of risk interacting with the impact area

Each of the statements should be written in a way that can be assessed by the risk criteria in the consequence table (Table 13). It would be good to familiarise yourself with the consequence criteria before writing the statements.

TABLE 9: EXAMPLES OF AREAS OF THE COMMUNITY THAT MAY BE VULNERABLE TO THE IMPACTS FROM HAZARD(S)

PEOPLE	ECONOMY	ENVIRONMENT	SOCIAL SETTING	PUBLIC ADMINISTRATION
Young people	Local business	Listed threatened species flora or fauna	Recreation and social events and facilities	Commonwealth, State, local government governance
Elderly people	Economic hubs	Reserved or listed conservation areas	Faith-based events and facilities	Hospital, social, justice and health services / facilities
Individual with disabilities	Primary industries	Marine or freshwater values	Cultural norms and events	Emergency services facilities
Individual requiring assistance	Shopping centres	Air values	Community and family cohesion	Schools, education and child care
CALD community members	Tourism	Geological or soil values		Critical infrastructure assets
				Essential services /facilities
				Food supply network
				Transport network
				Communication network
				Banking and finance

When writing a risk statement, the general structure to follow is:

'A [source of risk] resulting in a [emergency event] will impact [area] resulting in [consequences].'

Examples of risk statements are presented below.

> A clash of power lines on a day of extreme fire danger ignites a bushfire that spreads and impacts the rural area of Huonville resulting in extensive damage to infrastructure, orchards, forests and crop of the apple industry causing a serious economic impact to the industry.

> A lone armed offender attacks people at MONA resulting in death and injury to patrons.

> A solar flare event leads to an energy supply emergency that closes all power supply to the west of the state resulting in the breakdown of public administration.

All risk statements from the scenario should be entered into the risk register.
Ensure that risk statements can be answered with criteria in consequence tables.

> If you are using the TERR Tool, you need to enter the Risk Statement (column B), the Hazard type (column C) and the Impact area (column E). These can be used to sort the risks at a later time.

Remember: A risk results only when a vulnerable element of the community is exposed to a hazard. For example, a flood is a hazard but does not present a risk unless it interacts with people, transport routes, or sensitive areas.

ACTION 5: Identify existing controls

The final step to consider is what currently exists to prevent the impacts of such events. These measures are called controls. Controls can include approaches that:

- avoid the risk (e.g. land-use planning to move vulnerable elements away from risks)
- remove the risk source (e.g. stabilise steep cliffs to remove landslide risk sources)
- modify the consequence (e.g. strengthen buildings to minimise hazard impacts)
- modify the likelihood of the risk (e.g. road safety improvements to minimise road crash likelihood)
- retain the risk by informed decision (e.g. public education about the risks)
- share the risk (e.g. insurance)

Hazard management authorities listed in the TEMP 8, should undertake initial analysis of the hazards and the controls (programs and activities) that they are responsible for and invest in and be prepared to bring this evidence to the table during the risk workshops. Existing controls across the prevention, preparedness, response and recovery spectrum (PPRR) should be identified with regard to the intended risk source, hazard, impact area and risk statement (if known) before risk assessment workshops (Table 10). A list of existing controls identified in the TSNDRA is included in the SES toolbox. The effectiveness of these controls, and any additional controls, is to be considered collectively during the risk assessment workshop.

TABLE 10: EXAMPLE RISK STATEMENTS AND CONTROLS

RISK STATEMENT	RISK SOURCE	HAZARD	IMPACT AREA	EXISTING CONTROLS
A significant rainfall event in <location> causing flooding will impact the health of persons and cause death(s).	Severe rainfall	Flood	People	· Early warning system · Flood forecasting · Flood information brochures pre-season · Flood awareness kits · SES rescue boats available but limited · Evacuation plan including shelters · Early warning system · Flood forecasting · Drainage system maintenance · Farm dams
A significant rainfall event in <location> causing flooding will impact crops and consequently harvest, resulting in financial losses.		Flood	Economy	· Some business continuity plans in place · Land-use zoning · Early warning system · Flood awareness kits · Radio announcements · Evacuation plan including shelters
A significant rainfall event in<location> causing flooding will result in evacuation to safe accommodation away from people's homes, resulting in dispersal of the community.		Flood	Social setting	· SES rescue boats available but limited · Evacuation signs

Identify the risks checklist

You should have completed the following 'Identify the risks' tasks before moving on:

- ✓ Identify and describe all hazards and their sources considered in the risk assessment.
- ✓ Identify elements that are exposed and vulnerable to hazard(s).
- ✓ Develop a credible worst-case scenario that can be used for risk analysis during the workshop.
- ✓ Write risk statements for each hazard and impact area.
- ✓ Hazard management authorities identify existing controls that may modify risk.
- ✓ Update risk register or TERR Tool with hazard(s), risk statements, impact areas.

CHAPTER 8:

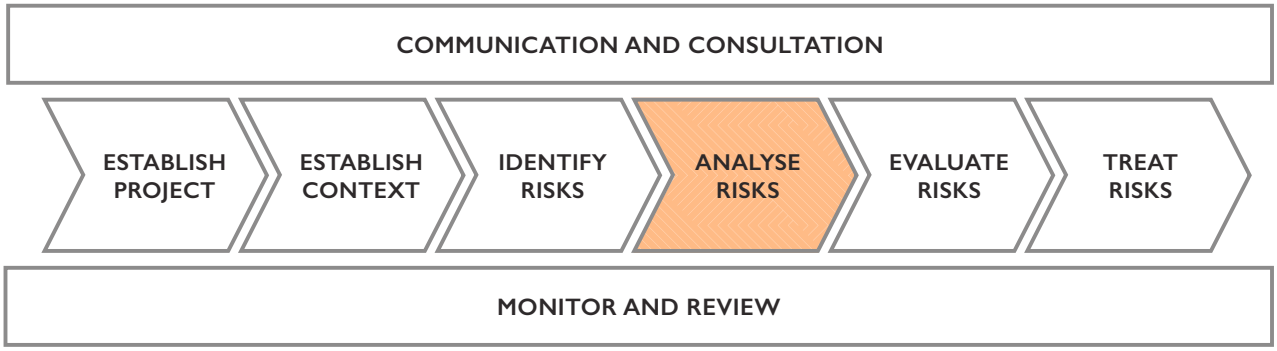
Analyse the risks

CHAPTER 8:

Analyse the risks

Risk analysis, Figure 12, is the "systematic process to understand the nature of and to deduce the level of risk."[14]

FIGURE 12: ERM PROCESS – ANALYSE RISKS



In Chapter 7, we created a series of risk statements. This chapter explains the workshop process used to analyse these statements to determine the risk level of each statement. The level of a risk is determined by identifying its likelihood of occurrence and consequence(s). The consequence table (Table 13) and likelihood table (Table 14) criteria from the NERAG have been adapted to the Tasmanian context. The chosen consequence and likelihood levels are then used to assign an overall risk level for each risk statement using the risk matrix (Table 16).

Risk analysis is best undertaken in a workshop with all relevant stakeholders present. Information from the actions in this chapter will populate your risk register created in Chapter 7.

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Objective

To determine the consequences and likelihood of risks and assign risk levels.

Output

- **Recorded consequence and likelihood of risk statements**
- **Assigned risk and confidence levels**
- **Updated risk register**

Actions

(1) **Determine the effectiveness of current controls**
(2) **Assign a consequence level**
(3) **Assign a likelihood level**
(4) **Assign a risk level**
(5) **Determine confidence level**

ACTION 1: Determine the effectiveness of current controls

- a. How **well** does the control reduce risk?
- b. How **easily** can the control be activated and used?

The effectiveness of controls is directly related to the scenario being considered. The controls may affect the likelihood of the event occurring or the likelihood of the risk statement being fully materialised. Many controls exist, and these are listed in the tables of controls for each natural hazard in the toolbox. The controls may apply as part of prevention, preparedness, response or recovery activities and are designated as:

- Material / Physical – elements in the landscape that affect the risk
- Procedural – systems and processes of management
- Behavioural – knowledge and actions of individuals or groups

Determining the level of existing controls is achieved using a multi-criteria analysis. Table 11 provides generic qualitative descriptors of levels of control. Controls can be considered with regard to their strength and/or expediency. Control strength refers to the ability of the control to achieve its objective if it operates as intended. (Control strength could also apply to a group of controls.) Control expediency refers to the ability of the control to be used/deployed readily and the control's acceptability to stakeholders. Note that a single control may have different levels of strength and expediency. Using the level of control strength and expediency, the overall level of existing control can be determined using the control level matrix (Table 12). This will later be used to inform the likelihood of the consequence occurring (Table 16).

As a group, consider how effective the prevention, preparedness, response and recovery controls are for the risk statement, and place the level in the risk register. It is valuable here to have the control owner in the group to explain and provide evidence about the level of control effectiveness.

> If you are using the TERR Tool, you need to enter the Control Strength (column F) and Control Expediency (column G) so that the tool can use it in the automatic overall Control Effectiveness (column H).

TABLE 11: CONTROL STRENGTH AND EXPEDIENCY MEASURES

Level	Control strength	Control expediency
HIGH	Control is highly effective in reducing the level of risk	The control is frequently applied.
MEDIUM	Control is effective in reducing the level of risk	The control is infrequently applied and is outside of the operators' everyday experience. The use of the control has been foreseen and plans for its application have been prepared and tested. Some extraordinary cost may be required to apply the control.
LOW	Control has some effect in reducing the level of risk	The control is applied rarely and operators may not have experienced using it. The use of the control may have been foreseen and plans for its application may have been considered, but it is not part of normal operational protocols and has been tested. Extraordinary cost is required to apply the control, which may be difficult to obtain.
VERY LOW	Control has almost no effect in reducing the level of risk	Application of the control is outside the experience and planning of operators, with no effective procedures or plans for its operation. It has not been foreseen that the control will ever need to be used. The application of the control requires significant cost over and above existing resources, and the cost will most likely be objected to by a number of stakeholders.

TABLE 12: LEVEL OF EXISTING CONTROL EFFECTIVENESS MATRIX

	CONTROL EXPEDIENCY			
CONTROL STRENGTH	VERY LOW	LOW	MEDIUM	HIGH
High	LOW	MEDIUM	MEDIUM	HIGH
Medium	LOW	MEDIUM	MEDIUM	MEDIUM
Low	VERY LOW	LOW	MEDIUM	MEDIUM
Very Low	VERY LOW	VERY LOW	LOW	LOW

ACTION 2: Assign a consequence level

The NERAG consequence table has been tailored to the Tasmanian context (Table 13). This table shows how the impacts of an emergency event can be categorised from 'insignificant' to 'catastrophic' according to the five key impact areas. While establishing the risk criteria (Chapter 6), you would have considered the measures in the table and set them for the assessment.

When assigning a consequence level to a risk statement, it is important that the most serious consequence is chosen. For example, while there might only be a 20% chance of a major consequence for a risk statement and an 80% change of a moderate consequence, the higher consequence needs to be chosen. (If your group is particularly interested in the 80% event, a second scenario will need to be created.) So when doing the risk assessment, begin on the right of the consequence table (catastrophic level) and work left until you find the appropriate consequence level, i.e. start with the highest consequence and work towards the lowest consequence. You will note in the consequence table there can be more than one sub-point in a category. It only needs to meet one, not all, of these sub-points to fit into that consequence.

For example, for a risk statement to have a catastrophic economic impact, it may be that >4% of the gross area product is lost, but there is no failure of a significant industry. In this case, the risk statement would still be assigned a catastrophic consequence level.

Remember: It is enough to meet only one of the criteria points of the consequence level; not all criteria in each box need to be met.

If you are using the TERR Tool, you need to enter the maximum Consequence level (column I) so that the tool can use it in the automatic overall Risk level (column L).

TABLE 13: TASMANIAN STATE CONSEQUENCE TABLE

CONSEQUENCE TABLE	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
PEOPLE					
Mortality	Not Applicable	Deaths greater than 1 in 10,000,000 people for the population of interest · 0.05 persons	Deaths greater than 1 in 1,000,000 people for the population of interest · >0.5 persons	Deaths greater than 1 in 100,000 people for the population of interest · >5 persons	Deaths greater than 1 in 10,000 people for the population of interest · >50 persons
Injuries/ Illness	Less than 1 in 1,000,000 of the population seriously injured or any minor injuries	More than 1 in 10,000,000 of the population critically injured with long-term or permanent incapacitation or 1 in 1,000,000 of the population seriously injured	More than 1 in 1,000,000 of the population critically injured with long-term or permanent incapacitation or 1 in 100,000 of the population seriously injured	More than 1 in 100,000 of the population critically injured with long-term or permanent incapacitation or 1 in 10,000 of the population seriously injured	More than 1 in 10,000 of the population critically injured with long-term or permanent incapacitation
ECONOMY					
Loss in economic activity and/ or asset value	· Decline of economic activity and/or loss of asset value <0.004% of gross area product · ~$100 000	· Decline of economic activity and/or loss of asset value · >0.004% of gross area product · ~$1 000 000	· Decline of economic activity and/or loss of asset value >0.04% of gross area product · ~$10 000 000	· Decline of economic activity and/or loss of asset value · >0.4% of gross area product · ~$100 000 000	· Decline of economic activity and/or loss of asset value · >4% of gross area product · ~$ 1 000 000 000
Impact on important industry	Inconsequential business sector disruption	Significant industry or business sector is impacted by the emergency event, resulting in short-term (i.e. less than one year) profit reductions	Significant industry or business sector is significantly impacted by the emergency event, resulting in medium-term (i.e. more than one year) profit reductions	Significant structural adjustment required by a significant industry to respond to and recover from emergency event	Failure of a significant industry or sector
ENVIRONMENT					
Loss of species and/ or landscapes	Minor damage of local or regional level significant and recognised ecosystem or species	· Significant loss/ impairment of state-level significant and recognised ecosystem or species · Minor damage of regionally significant and recognised ecosystem or species	· Significant loss/ impairment of nationally-significant and recognised ecosystem or species · Severe damage of state-level significant and recognised ecosystem or species · Permanent destruction of regionally significant and recognised ecosystem or species	· Severe damage or loss of nationally-significant and recognised ecosystem or species · Permanent destruction of state-level significant and recognised ecosystem or species	Permanent destruction of nationally-significant and recognised ecosystem or species
Loss of environ-mental value	Inconsequential damage to environmental values of interest	Minor damage to environmental values of interest	Significant damage to environmental values of interest	Severe damage to environmental values of interest	Permanent destruction of environmental values of interest

CONSEQUENCE TABLE

	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
PUBLIC ADMINISTRATION					
Governance functions	Governing bodies' and institutions' delivery of core functions is unaffected or within normal parameters	Governing bodies and institutions encounter limited reduction in delivery of core functions	· Governing bodies and institutions encounter significant reduction in the delivery of core functions · Governing bodies and institutions are required to divert some available resources to deliver core functions or seek external assistance to deliver some of their core functions	· Governing bodies and institutions encounter severe reduction in the delivery of core functions · Governing bodies and institutions are required to divert a significant amount of available resources to deliver core functions or seek external assistance to deliver the majority of their core functions	Governing bodies and institutions are unable to deliver their core functions
SOCIAL SETTING					
Community wellbeing	· Community social fabric is disrupted · Existing resources sufficient to return the community to normal function · No permanent dispersal	· Community social fabric is damaged · Some external resources required to return the community to normal function · No permanent dispersal	· Community social fabric is broken · Significant external resources required to return the community to normal function · No permanent dispersal	· Community social fabric is significantly broken · Extraordinary external resources required to return the community to functioning effectively · Significant permanent dispersal	· Community social fabric is irreparably broken · Community ceases to function effectively, breaks down · Community disperses in its entirety
Culturally important objects	Minor damage to objects of identified cultural significance	Damage to objects of identified cultural significance	Widespread damage to objects of identified cultural significance	Widespread damage or localised permanent loss of objects of identified cultural significance	Widespread permanent loss of objects of identified cultural significance
Community services	Inconsequential / short-term reduction	Isolated/temporary reductions	Ongoing reductions	Reduced quality of life	Community unable to support itself
Culturally important activities	Minor delay of a major culturally important activity or event	Delay of a major culturally important activity or event	Some delay or reduced scope to a major culturally important activity or event	Temporary cancellation or significant delay to a major culturally important community activity or event	Permanent cancellation of a major culturally important community activity or event

ACTION 3: Assign a likelihood level

The likelihood is defined as "the chance of something happening".

Two parts contribute to the overall likelihood of a risk:

- a. the probability of the emergency event (e.g. flood) occurring
- b. the probability of the risk statement occurring (e.g. people being displaced).

These two parts can be determined separately.

Likelihood (%) = Probability of Event x Probability of Risk Statement

Determining the probability of an event

The probability of the emergency event occurring is determined in Chapter 7 (Action 3). Table 14 shows how the NERAG assigns likelihood levels to the two modes of probability, AEP and ARI, which were discussed in Chapter 7.

Determining the event probability would occur before the workshop, during the development of the scenario, so participants do not get confused thinking they need to know how often a hazard occurs. For example, if the risk statement says "a rainfall event across the region will cause flooding that will result in inundation of an aged-care facility", the workshop participants do not need to determine how often the rainfall event occurs, but rather if it did, would the aged-care facility flood? **Hence in the workshop, participants need only decide on the probability of the risk statement occurring.**

> If you are using the TERR Tool, you need to enter the Likelihood level (column D) so that the tool can use it in the automatic overall likelihood calculation. If you have more than one hazard in your spreadsheet, be sure that each hazard scenario has an individual Likelihood level.

Remember: All risk statements for a particular hazard scenario should use the same AEP.

TABLE 14: LIKELIHOOD LEVEL OF EVENT COMPARISON TABLE[15]

LIKELIHOOD LEVEL	ANNUAL EXCEEDANCE PROBABILITY IN % (AEP)	AVERAGE RECURRENCE INTERVAL (ARI) (INDICATIVE)	FREQUENCY (INDICATIVE)
Almost Certain	63% per year or more	1 year or less	Once or more per year
Likely	10 - <63% per year	1-10 years	Once per 10 years
Unlikely	1 - <10% per year	11-100 years	Once per 100 years
Rare	0.1 - <1% per year	101-1000 years	Once per 1000 years
Very Rare	0.01 - <0.1% per year	1001-10,000 years	Once per 10,000 years
Extremely Rare	<0.01% per year	10,001 years or more	Once per 100,000 years

15 *A logarithmic scale is used because the probability of emergency events can cover several orders of magnitude.*

Determine the probability of a risk statement occurring

The risk statement occurrence is determined by considering the effectiveness of the current controls to the scenario and its subsequent risk statements. This probability focuses on whether the particular risk statement would occur, given that the emergency event is happening. The more refined the risk statement with regard to the timing, location and impacted community element, the more exact the result will be. The likelihood is the collective opinion of the workshop of the combined likelihood of the event occurring (given by the scenario) and the consequence occurring, given the effectiveness level of the controls from Table 12. This combined likelihood is shown in Table 15.

> If you are using the TERR Tool, it will automatically modify the combined Likelihood level (column K) based on the control effectiveness loaded at column H.

TABLE 15: LIKELIHOOD OF THE CONSEQUENCE MATERIALISING GIVEN LEVEL OF CONTROL AND AEP (SCALE OF EVENT)

	CONTROL IMPACT ON CONSEQUENCE			
AEP OF EVENT	VERY LOW	LOW	MEDIUM	HIGH
63% per year or more	ALMOST CERTAIN	ALMOST CERTAIN	LIKELY	LIKELY
10 – <63% per year	LIKELY	LIKELY	UNLIKELY	UNLIKELY
1 – <10% per year	UNLIKELY	UNLIKELY	UNLIKELY	RARE
0.1 – <1% per year	RARE	RARE	RARE	VERY RARE
0.01 – <0.1% per	VERY RARE	VERY RARE	VERY RARE	VERY RARE
<0.01% per year	EXTREMELY RARE	EXTREMELY RARE	EXTREMELY RARE	EXTREMELY RARE

ACTION 4: Assign a risk level

Now that consequence and likelihood levels have been assigned to the risk statement, the risk level can be determined using the risk matrix. This calculation will be automatically done in the TERR Tool (column L), but if done manually, see Table 16. For example if you take the likelihood level of 'Unlikely' and the consequence level of 'Moderate', you can assign a risk level of 'Medium'.

TABLE 16: TASMANIAN EMERGENCY RISK ASSESSMENT LIKELIHOOD/CONSEQUENCE MATRIX

	CONSEQUENCE LEVEL				
LIKELIHOOD	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
Almost Certain	MEDIUM	MEDIUM	HIGH	EXTREME	EXTREME
Likely	LOW	MEDIUM	HIGH	EXTREME	EXTREME
Unlikely	LOW	LOW	MEDIUM	HIGH	EXTREME
Rare	VERY LOW	LOW	MEDIUM	HIGH	HIGH
Very Rare	VERY LOW	VERY LOW	LOW	MEDIUM	HIGH
Extremely Rare	VERY LOW	VERY LOW	LOW	MEDIUM	HIGH

ACTION 5: Determine the confidence level

Since the results of this risk assessment will be used to make decisions about potential treatment options, the confidence of the assessment needs to be considered. Participants determine the confidence level during the workshop based on how confident they are about their assessments of the consequence and likelihood levels. A conservative approach should be taken and the lowest of the three criteria measures selected.

The confidence level table (Table 17) provides descriptions for five confidence levels ('lowest' to 'highest') based on the following criteria:

- Supporting evidence: the reliability, relevance and currency of the evidence used to support the risk assessment
- Expertise: the use of appropriate expertise as part of the risk assessment process in assigning the likelihood and consequence levels
- Participant agreement: the level of agreement between stakeholders

A confidence level ('lowest' to 'highest') is required for each risk statement and should be entered into your risk register.

If you are using the TERR Tool, you need to select the Confidence level (column J) so that the tool can use it in the automatic overall likelihood calculation.

TABLE 17: CONFIDENCE LEVEL

CONFIDENCE LEVEL					
	LOWEST	LOW	MODERATE	HIGH	HIGHEST
Confidence descriptor	Assessed consequence/ likelihood could be one of four or more levels, with fundamental uncertainty	Assessed consequence/ likelihood risk could be one of three or more levels, with major uncertainty	Assessed consequence/ likelihood could be one of two levels, with significant uncertainty	Assessed consequence/ likelihood has only one level, but with some uncertainty in the assessment	Assessed consequence/ likelihood is easily assessed to one level, with almost no uncertainty
Supporting evidence	No historical events or quantitative modelled results to support the levels	Some comparable historical events through anecdotal information or Quantitative modelling and analysis with extensive extrapolation of data required to derive results of relevance to the event being assessed	Historical event of similar magnitude to that being assessed in a comparable community of interest or Quantitative modelling and analysis with reasonable extrapolation of data required to derive results of direct relevance to the event being assessed	Recent historical event of similar magnitude to that being assessed in a directly comparable community of interest or Quantitative modelling and analysis uses sufficient quality and length of data to derive results of direct relevance to the event being assessed	Recent historical event of similar magnitude to that being assessed in the community of interest or Quantitative modelling and analysis of highest quality and length of data relating directly to the affected community, used to derive results of direct relevance to the scenario being assessed
Expertise	No relevant technical expertise is available to the team for analysis	Risk assessment team contains technical expertise related to the field being assessed and Technical expertise is taken into account by the risk assessment team	Risk assessment team contains relevant technical expertise in the field being assessed, and experience in data and/or modelling of relevance to the event being assessed and Technical expertise is used by the risk assessment team	Risk assessment team contains relevant technical expertise in the field being assessed, and experience with data and/or modelling relating to the event being assessed and Technical expertise is highly influential in the decisions of the risk assessment team	Risk assessment team contains relevant and demonstrated technical expertise in the field being assessed, and experience in data and/or modelling of direct relevance to the scenario being assessed and Technical expertise is highly influential in the decisions of the risk assessment team
Participant agreement	Fundamental disagreement on level of consequence, with little prospect of agreement	Disagreements on fundamental issues relating to the assessment of consequence, which would lead to a range of rating levels	Disagreement on significant issues, which would lead to different levels of consequence depending on which argument was followed	Disagreement on only minor aspects, which have little effect on the assessment of level of consequence	Agreement among participants on the assessment of levels of consequence

Update risk register with risk analysis information

After analysing the risks, the following information needs to be updated in your risk register (Table 18) or TERR Tool:

- Control effectiveness
- Consequence level
- Probability of risk statement occurring
- Likelihood level
- Confidence level
- Risk level (calculated automatically in the TERR Tool)

For ease within the workshop, one risk assessment team member may want to facilitate discussion while another team member enters the information into the TERR Tool as the group works through the risk statements.

TABLE 18: UPDATED RISK REGISTER EXAMPLE (ONLY SHOWING THE RISK ANALYSIS PART OF THE RISK REGISTER)

RISK STATEMENT: A significant rainfall event in <location> causing flooding will impact the health of persons and cause death(s).

Control Strength	Control Expediency	Control Effectiveness	Consequence Level	Likelihood Level	Confidence Level	Risk Level
Medium	Low	Medium	Moderate	Likely	Moderate	Medium

RISK STATEMENT: A significant rainfall event in <location> causing flooding will impact crops and consequently harvest, resulting in financial losses.

Control Strength	Control Expediency	Control Effectiveness	Consequence Level	Likelihood Level	Confidence Level	Risk Level
Low	Low	Low	Major	Unlikely	Low	High

RISK STATEMENT: A significant rainfall event in <location> causing flooding will result in evacuation to safe accommodation away from people's homes, resulting in dispersal of the community.

Control Strength	Control Expediency	Control Effectiveness	Consequence Level	Likelihood Level	Confidence Level	Risk Level
High	High	High	Minor	Rare	High	Low

Analyse the risks checklist

You should have completed the following 'Analyse risks' tasks before moving on:

- ✓ Determine a level of control effectiveness for each of prevention, preparedness, response and recovery
- ✓ Assign a consequence level to each risk statement
- ✓ Assign a likelihood level to each risk statement
- ✓ Determine the risk level of each risk statement
- ✓ Determine the confidence level of your assessment for each risk statement
- ✓ Update the risk register or TERR Tool

CHAPTER 9:

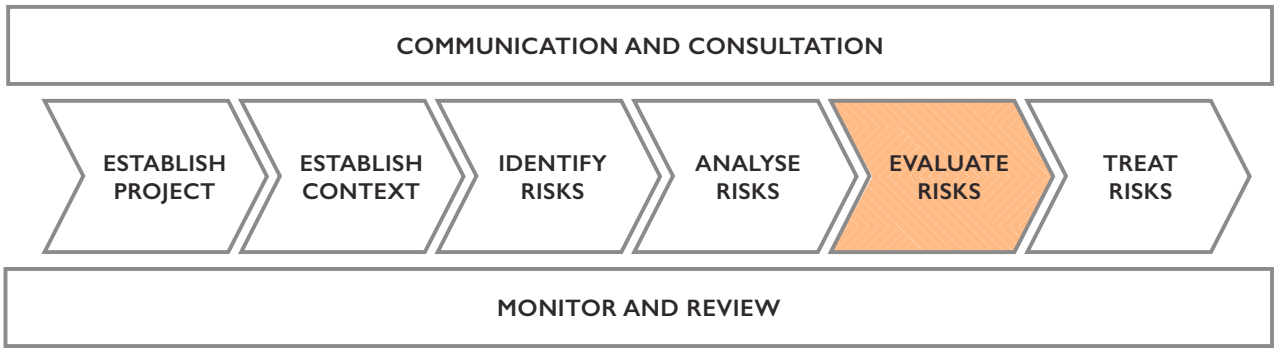
Evaluate the risks

CHAPTER 9:

Evaluate the risks

Risk evaluation is the process of determining whether the risk and/or its magnitude is acceptable or tolerable (Figure 13).

FIGURE 13: ERM PROCESS – EVALUATE THE RISKS



Evaluating the risks helps to determine which risks may require further detailed assessment or treatment, and prioritises measures to reduce risk levels. It is likely that this phase will need to be undertaken with decision-makers and technical experts.

A further workshop or special Municipal Emergency Management Committee meeting with appropriate decision-makers present may be best. The information produced in this phase will need to be included in the Local Risk Assessment Summary Document that is available in the toolbox.

Objective

Decide which risks may require further detailed assessment or treatment, and prioritise measures to reduce risk levels.

Output

- **List of risks that require treatment or further analysis**
- **An updated risk register with the priority assigned to each risk**

Actions

(1) **Assign a priority to each risk**
(2) **Determine how to address the prioritised risks**
(3) **Plan further analysis**
(4) **Enter information into risk register**

ACTION 1: Assign a priority to each risk

The aim of risk evaluation is to assign a priority to each risk, based on the risk level and confidence level. The priority ranges from 1 (highest priority, needing the highest level of attention) to 5 (lowest priority, needing monitoring and maintenance of existing controls).

Priority is determined by:

- the risk level (higher risk level leads to higher priority)
- the level of confidence (lower confidence leads to higher priority)

The response to a level of priority is to:

- improve the confidence level of the risk (if possible) through research, further expert judgement or further investigations (Chapter 8, Action 5)
- treat the risk by taking action to reduce the likelihood or consequence of the risk (Chapter 10)
- monitor and review the risk as part of the ongoing risk management process (Chapter 10)

Table 19 lists general descriptions for each priority and the responsible committee for monitoring treatments.

TABLE 19: PRIORITY RATING WITH DESCRIPTION AND ACTION PATHWAY

PRIORITY	GENERAL DESCRIPTOR: ACTION PATHWAY	COMMITTEE
1	Highest priority for further investigation and/or treatment, and the highest authority relevant to context of risk assessment must be formally informed of risks. Each risk must be examined, and any actions of further investigation and/or risk treatment are to be documented, reported to and approved by that highest authority.	**REMC**
2	High priority for further investigation and/or treatment, and the highest authority relevant to context of risk assessment should be formally informed of risks. Further investigations and treatment plans should be developed.	**REMC**
3	Medium priority for further investigation and/or treatment. Actions regarding investigation and risk treatment should be delegated to appropriate level of organisation, and further investigations and treatment plans may be developed.	**MEMC**
4	Low priority for further investigation and/or treatment. Actions regarding investigation and risk treatment should be delegated to appropriate level of organisation, and further investigations and treatment plans may be developed.	**MEMC**
5	Broadly acceptable risk. No action required beyond monitoring of risk level and priority during monitoring and review phase.	**MEMC**

If you are using the paper version of the risk register, then information about determining priority is provided as follows. The confidence level in the risk assessment (Chapter 8) is used to select the table from the toolbox that is used to determine priority. For example, a risk with a major consequence and a rare likelihood that has been assessed with the highest confidence level would lead to a risk priority of 3. If the same risk was assessed with a low confidence level, the risk priority would be a priority of 2.

If you are using the TERR Tool, priority is automatically generated and appears in column M.

ACTION 2: Determine how to address the prioritised risks

This stage considers whether any further action is to be undertaken for each risk. The following issues need to be considered for each risk:

- the urgency of the risk treatment (i.e. whether there is enough time to conduct further detailed analysis)
- whether the confidence level of the risk can realistically be increased
- whether an improvement in confidence through more research or investigation would provide a different priority
- whether a different priority would change the management response

Further analysis should be considered if:

- a proposed treatment could have a negative impact on the hazard, which could increase and/or shift the risk to a new area
- it will increase the risk assessment confidence

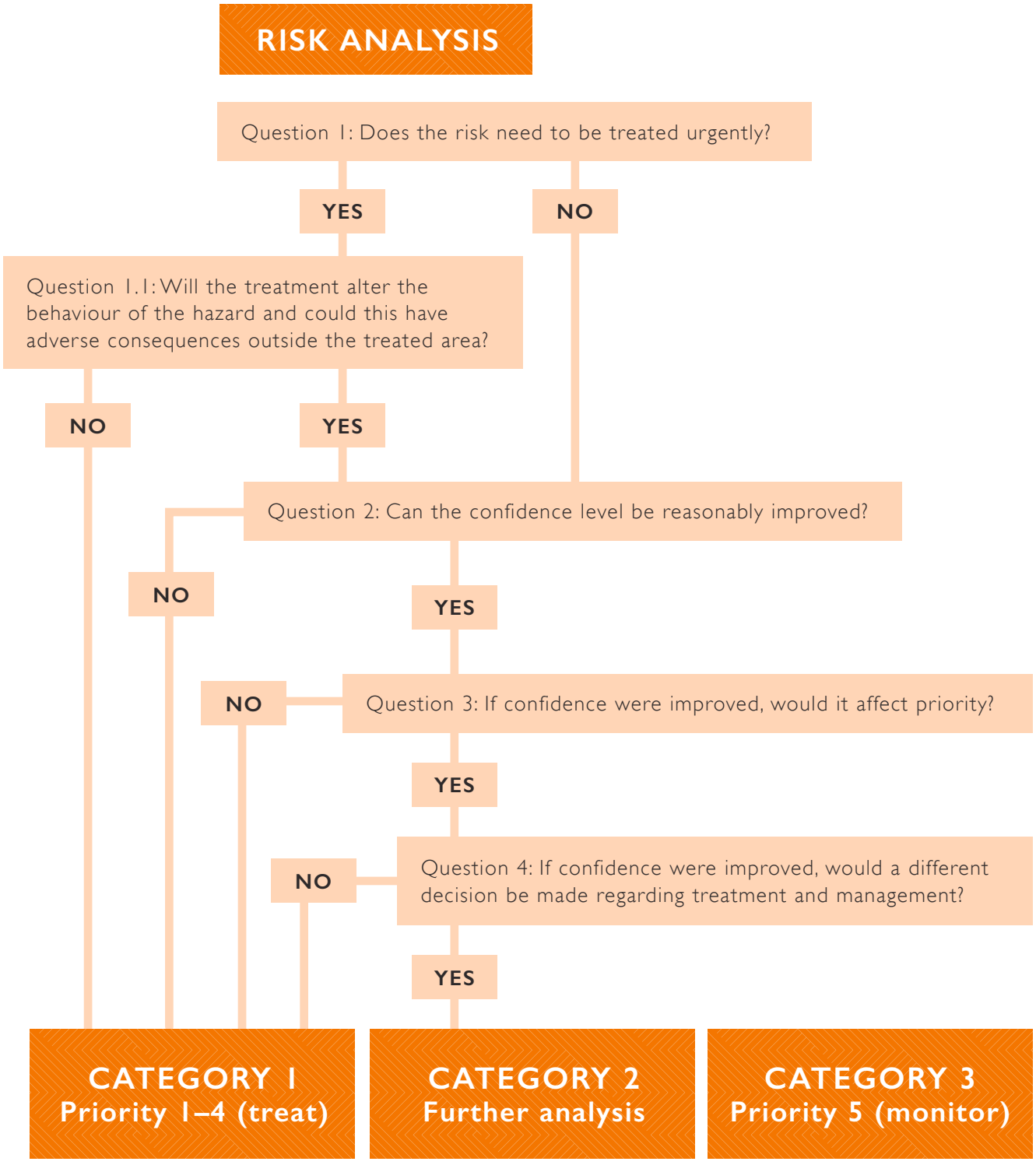
At the end of this stage, each evaluated risk is assigned one of these categories:

- Category 1: Risk requires treatment (with confidence to determine treatment objectives).
- Category 2: Risk requires further analysis (which may require a further investigation or workshop).
- Category 3: Risk (currently) requires ongoing monitoring and maintenance of existing controls.

Assessors are to use the decision tree at Figure 14 to support their decisions.

If you are using the TERR Tool, you need to select the Treatment Option in column N.

FIGURE 14: DECISION TREE FOR RISK TREATMENT BASED ON PRIORITY



ACTION 3: Plan further analysis

Detailed analysis should be undertaken on risks where:

- the current analysis does not provide enough information for a reasonable decision to be made on the risk level
- the current analysis does not provide enough information on how effective the proposed treatment strategy will be
- the risk treatment has the potential to have adverse effects on hazard behaviour that need to be considered in decision-making

These are the Category 2 risks of the risk evaluation process. Detailed analysis may involve investigating and researching a number of key risks, or beginning a new risk assessment with a more focused context. At this stage, semi-quantitative or quantitative methods may be used (such as analysis of historical impacts or consequences of past emergency events). These methods are particularly likely to be useful if the treatments considered are either expensive or will have a widespread impact on the community. After considering the further analysed risks, the risk assessment team can finalise the assessment of the relevant risk(s) by re-evaluating them. The re-evaluation of the risk(s) should include specialists in detailed assessment to compare the two sets of results. Reanalysis and re-evaluation of risk(s) must be recorded in the risk register.

ACTION 4: Enter information into risk register

The risk register will have automatically generated the priority setting (see Table 20).

To update the TERR Tool, select treatment, further analysis or monitor and review from the table.

TABLE 20: UPDATED RISK REGISTER EXAMPLE (ONLY SHOWING THE RISK PRIORITY PART OF THE RISK REGISTER)

RISK STATEMENT	RISK PRIORITY	TREATMENT OPTION
There is potential that a significant rain event across (location) causing widespread flooding could cause serious injury or death to one or more people	2	**Treat**
There is a risk that a flood will cause extensive relocation of residents and public from areas at risk for periods of 24 hours or more	1	**Analyse**
There is a risk that a flood will cause substantial damage to infrastructure services that may result in shutdown and inconvenience to residents for periods of 24 hours or more	5	**Monitor**

Evaluate the risks checklist

You should have completed the following 'Evaluate the risks' tasks before moving on:

- ✓ Assign a priority to each risk
- ✓ Determine whether evaluated risks require:
  - treatment
  - further analysis, or
  - ongoing monitoring and maintenance of existing controls
- ✓ Plan further analysis if required
- ✓ Enter information into risk register

CHAPTER 10:

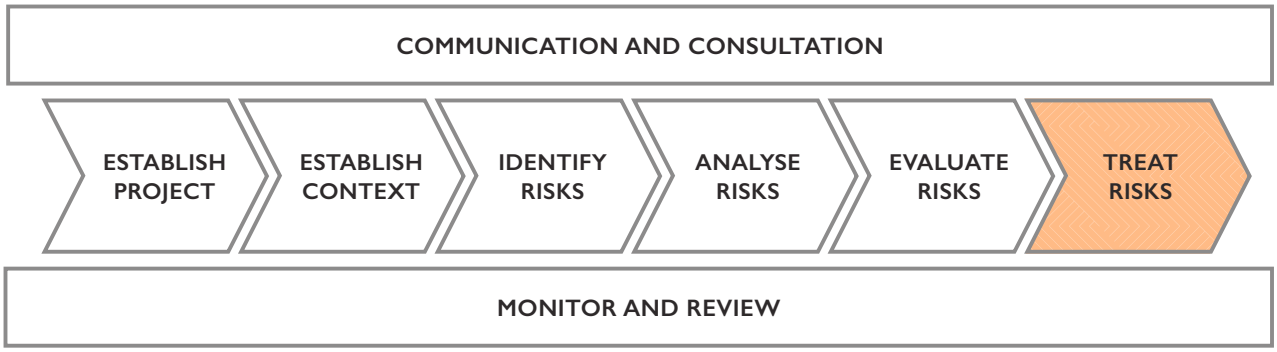
Treat the risks

CHAPTER 10:

Treat the risks

A risk treatment is the removal of a risk source or implementation or improvement in the controls to reduce the level of risk, and it is the last phase in the ERM process (Figure 15).

FIGURE 15: ERM PROCESS – TREAT THE RISKS



Evaluating the risks, explained in Chapter 9, should have produced a list of risks that need to be treated and others that need to be monitored. The risk treatment phase aims "to determine and implement the most appropriate action(s) in response to the identified need to treat risks."

Objective

Determine and implement the most appropriate action(s) for risks requiring treatment.

Output

A risk treatment plan

Actions

(1) **Identify treatment options**
(2) **Evaluate treatment options**
(3) **Select appropriate treatments**
(4) **Develop the treatment plan**
(5) **Add treatment strategies to the risk register**

ACTION 1: Identify treatment options

Identifying and designing treatment strategies requires a comprehensive understanding of the risks to ensure the causes of risks are treated, not just the symptoms. To do this, complete the following:

- Consider the effectiveness of existing mitigation controls that are in place.
- Create a list of potential treatment options for each risk using the six strategies outlined in Table 21. These can be a single approach, or a combination of multiple.

If you are using the TERR Tool, you need to select the strategy in column N.

TABLE 21: EXAMPLES OF BROAD TREATMENT APPROACHES

RISK MANAGEMENT STRATEGY	EXAMPLE
Avoid the risk	Prevent further development in hazard-prone areas
Remove the risk source	Remove hazardous waste from near built-up areas
Change the consequence of the risk	Legislate hazard-specific building regulations
Change the likelihood of the risk	Build a sea wall to reduce the likelihood of coastal flooding (only large storm surges will overtop the wall)
Retain the risk by informed decision	Community acknowledges the existence of the risk but decides against treatment (e.g. retaining bushland near homes despite the risk of bushfire)
Share the risk	Share the risk with another party such as insurance companies

ACTION 2: Evaluate treatment options

Evaluate the identified treatment options for each risk statement that requires treatment (Category 1 risks from Chapter 9, Action 2) based on:

- Initial cost-benefit analysis: Used to determine whether the benefits of the treatment strategy option outweigh the financial, societal or other costs resulting from implementing the treatment option.
- Effectiveness of treatment options: Assesses how effective the treatment strategy will be and whether this is enough to justify implementation.
- Further risk analysis, if applicable: Give consideration to any further analysis conducted during the risk evaluation stage.
- Acceptability of residual risks: Consider the residual risk that will remain after the treatment option is implemented and decide whether to accept these risks.

ACTION 3: Select appropriate treatments

The selection of a strategy and treatment options requires consultation with stakeholders. The following should be done:

- Discuss results of the evaluation of treatments until a single treatment/mix of treatments emerges as the most sensible, efficient and cost-effective way of dealing with the identified risk.
- List possible treatments in order of priority.
- Remember to include why you chose that treatment, its benefits, and the resources required to implement it.

ACTION 4: Develop the treatment plan

Develop an agreed strategy to manage the risk and a treatment plan that delivers that strategy. The plans for delivery may be simple and within control of the stakeholders, or major and require significant budgetary, time or stakeholder involvement. Each will require a different approach.

Government agencies undertaking risk analysis must also be mindful of any state or national requirements which may affect treatments options, such as regulation. There are nationally agreed approaches for evaluating regulatory courses of action.

ACTION 5: Add treatment strategies to the risk register

Add the treatment information to the risk register (Table 22).

> If you are using the TERR Tool, you need to place a freehand summary of actions and responsible entities in column P.

TABLE 22: UPDATED RISK REGISTER EXAMPLE (ONLY SHOWING THE TREATMENT PART OF THE RISK REGISTER)

PRIORITY LEVEL	RISK STATEMENT	RISK TREATMENT ACTIONS
1	A significant rainfall event in <location> causing flooding will impact the health of persons and cause death(s).	· Further develop and implement early warning systems · Run a pre-season advisory/awareness campaign on risk mitigation activity and options · Develop a specific flood response plan including a detailed evacuation plan · Establish arrangements with medical services for a cooperated response
3	A significant rainfall event in <location> causing flooding will impact crops and consequently harvest, resulting in financial losses.	· Encourage business continuity plans, e.g. use harvest for stock feed · Plan land use · Maintain culverts · Improve farm dams
3	A significant rainfall event in <location> causing flooding will result in evacuation to safe accommodation away from people's homes, resulting in dispersal of the community.	· Identify access routes for safe self-evacuation · Increase SES resources, e.g. rescue boats · Further develop a detailed evacuation plan including roles, responsibilities and resourcing · Run a pre-season advisory/awareness campaign on risk mitigation activity and options

Treat the risks checklist

You should have completed the following 'Treat the risks' tasks before moving on:

- ✓ Identify all treatment options
- ✓ Evaluate and select appropriate treatment options for each risk statement
- ✓ Develop a treatment plan
- ✓ Update the risk register or TERR Tool

CHAPTER 11:

Definitions

CHAPTER 11:

Definitions

Terms used throughout the series of documents have the meanings given in Section 3 of the *Emergency Management Act 2006* Tas., the National Emergency Risk Assessment Guidelines, Handbook 10 and the UNISDR EM Glossary.

Specific definitions relevant to this guide are listed below.

All hazards	Managing all types of emergencies or disasters, and civil, defence, using the same set of management arrangements.
Annual exceedance probability (AEP)	The probability of an emergency event of a given size or larger occurring in a given year, expressed as a percentage.
AS/NZS ISO 31000:2009	International standard for risk management which forms the basis of the Emergency Risk Management Process.
Community	A group of people with a commonality of association and generally defined by location, shared experience or function.
Confidence	The trustworthiness or reliability of the evidence that supports risk assessments.
Consequence	Impact(s) of an event on the five key areas: environment, economy, people, social setting and public administration.
Control	A measure that modifies risk. This may be an existing process, policy, device, practice or other action that acts to minimise negative risk or enhance positive opportunities.
Control expediency	The ability of the control to be used or deployed readily in an acceptable manner.
Control strength	The ability of the control to achieve objectives when required and operating as intended.
Elements at risk	Components of the five key areas which may be at risk from hazards.
Emergency	Emergency Management Act 2006 Tasmania; Part 1.3 (a) an event that –(i) endangers, destroys or threatens to endanger or destroy human life, property or the environment, or causes or threatens to cause injury or distress to persons; and (ii) requires a significant response from one or more of the statutory services; or (b) a significant threat of the occurrence of an event of a kind referred to in paragraph (a) in respect of which it is appropriate to take measures – (i) to prevent that possible resulting event; or (ii) to mitigate the risks associated with that threat and that possible resulting event

Emergency Risk Management (ERM)	A systematic process which contributes to the wellbeing of communities and the environment. The process considers the likely effects of hazardous events and the controls by which they can be minimised.
Event	Occurrence or change of a particular set of circumstances.
Frequency	A measure of the number of occurrences per unit of time.
Hazard	Source of potential harm or a situation with a potential to cause loss.
Impact	To have a noticeable or marked effect on
Level of risk (or risk level)	Magnitude of a risk or a combination of risks, expressed in terms of the combination of consequences and their likelihood.
Likelihood	Chance of something happening. It is used as a general description of probability and may be expressed qualitatively or quantitatively.
Loss	Any negative consequence or adverse effect, financial or otherwise.
Matrix (plural matrices)	A graphical means of comparing and contrasting two elements.
Monitoring	To check, supervise, observe critically or record the progress of an activity, action or system on a regular basis in order to identify change.
Organisation	Group of people and facilities with an arrangement of responsibilities, authorities and relationships.
Preparedness	Preparation for response to an emergency.
Prevention	The mitigation or prevention of the probability of the occurrence of, and the potential adverse effects of, an emergency.
Probability	A measure of the chance of occurrence expressed as a number between 0 (uncertainty) and 1 (absolute certainty). "Frequency" or "likelihood" rather than "probability" may be used in describing risk.
Recovery	The support of emergency-affected communities in the reconstruction and restoration of physical infrastructure, the environment and community, psychological and economic wellbeing.
Residual risk	Risk remaining after risk treatment. Following implementation of risk treatment, residual risk can also be referred to as retained risk.
Resilience (UNISDR)	The ability of a system, community or society, exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structure and functions. This is determined by the degree to which the community has the necessary resources and is capable or organising itself both prior to and during times of need.
Response	The combatting of the effects of an emergency, provision of emergency assistance for casualties, reduction of further damage, and help to speed up recovery.

Risk (UNISDR)	The combination of the probability of an event and its negative consequences.
Risk analysis	Process to comprehend the nature of risk and to determine the level of risk.
Risk assessment	The overall process of risk identification, risk analysis and risk evaluation.
Risk criteria	The State's endorsed risk criteria and associated tools and guidelines which form the minimum required level of analysis/reporting.
Risk evaluation	Process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude are/is acceptable or tolerable.
Risk identification	The process of finding, recognising and describing risks.
Risk management	Coordinated activities of an organisation or a government to direct and control risk.
Risk management process	The systematic application of management of policies, procedures and practices to the tasks of communicating, consulting, establishing the context, and identifying, analysing, evaluating, treating, monitoring and reviewing risk.
Risk reduction	Actions taken to lessen the likelihood, negative consequences, or both, associated with a risk.
Risk register	A document usually presented in a tabular form which lists concisely the following information for each risk: the risk statement, source, hazard, impact area, prevention/preparedness controls, recovery/response controls, level of existing controls, likelihood level, risk level, confidence level, treatment strategy.
Risk source	An element which, alone or in combination, has the intrinsic potential to give rise to risk.
Risk tolerance	An organisation's or stakeholder's readiness to bear the risk after risk treatment to achieve its objectives.
Risk treatment	Process of selection and implementation of controls to modify risk. The term "risk treatment" is sometimes used for the controls themselves.
Stakeholders	A person, group of people or organisation that can affect, be affected by or perceive themselves to be affected by a decision or activity.
Susceptibility	The potential to be affected by loss.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors that vary within a community and over time.

CHAPTER 12:

Bibliography

CHAPTER 12:

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