chapter 9 conduct a climate change risk assessment

Based on your knowledge about the vulnerabilities of systems in your planning areas, you are now ready to conduct a climate change ***risk assessment*** of those systems – the second step necessary to identify your ***priority planning areas*** (defined in Section 9.2).

9.1 Assess Your Climate Change Risks

As in other fields that require risk management, the process of priority setting for your climate change preparedness efforts will be based on your estimation of climate risk to systems in your planning areas. Risk is defined and described here as:

Risk = Consequence x Probability

- **Consequence of an impact.** What are the known or estimated consequences (economic, ecological, social, cultural and legal) of a particular climate change impact? For example, consider how costly failure of a flood wall can be or how coastal ecosystems and development will be affected by different projections of sea level rise. This estimation may be qualitative (high, medium, low) and/or quantitative (e.g., $18 million for the failure of a flood wall). Your assessment of consequence should also factor in the estimated scale of the impact, such as the size of the population or land area affected by a projected climate change impact. Consider also the cumulative costs associated with a higher frequency of minor events.

- **Probability or likelihood of an impact.** How likely is it that a projected impact will occur? Some climate change impacts, such as increasing average temperatures and sea level rise, are virtually certain. The degree to which these changes affect existing problems or lead to new problems was evaluated in your vulnerability assessment. Probability can be assessed qualitatively (high, med, low), particularly in cases where resources are limited, information is limited, or the consequences of the impacts are small. In cases where a quantitative estimate of probability is warranted, consider using more technical analytical techniques.

Use the information collected for your vulnerability assessment (Chapter 8) to estimate the consequence, probability, and resulting risk of specific climate change impacts to systems in your planning areas. Have each member of the preparedness team perform their own risk assessment for

systems in their respective planning areas. Team members may also want to survey staff within their home departments and/or technical experts (e.g., scientists, engineers, resource managers) to develop a more robust view of risk for systems in their planning areas.

Other considerations that can affect basic estimations of risk are your planning time frame, the geographic scale of the risk assessment, and attitudes towards risk. Planning for the impacts of sea level rise provides a good example of how each of these additional criteria factor into evaluating risk. The risk that low-lying coastal areas will be permanently inundated by higher sea levels is greater in 40 years than in 20 years (absent any adaptation) given that sea level is projected to be higher in 40 years than in 20 years. The risk of coastal erosion and flooding due to sea level rise in one estuary may be significantly different than the next depending on variations in coastal morphology, plate tectonics (e.g. uplift and subsidence), development patterns, and how much assets along the coast line are valued. Finally, attitudes towards risk can affect how individuals within your community and the planning process view and accept certain levels of risk, as described in Box 9.1. The degree to which any of these factors significantly alters the conclusions of the risk assessment should be considered.

Box 9.1 – Risk Perception and Risk Tolerance

How risk is viewed (risk perception) and accepted (risk tolerance) will play a significant role in your risk evaluation. Risk perception and tolerance can vary widely between individuals, over time, and/or with different thresholds. For example, one community may rank the potential for more extreme heat events higher than a neighboring community because of different perceptions of the risk associated with extreme heat events in each community. In another case, communities may have a high tolerance for a small increase in the risk of a 100 year flood event (from 1% annually to 5% annually, for example) but that tolerance may change if the risk of the event changes from a 1% to a 20% annual probability. Which risks will your community be willing to accept? Which are unacceptable? Your government leadership and/or community may be prepared to take large risks in some areas and none at all in others, especially if that planning area is already under threat. Community meetings and interviews with government leaders may provide insight into what risks are and are not acceptable, and at what thresholds these distinctions are made.

One approach for sorting your risk assessment is identified in Table 9.1. It is good practice to describe why a high, medium, or low rating was assigned to a given system. You can also convert each qualitative statement into a numeric score (high=5, medium-high=4, medium=3, medium-low=2, and low=1) to develop risk scores for each impact. This can be particularly useful for evaluating results from larger group surveys.

For cases where the consequence or probability of an impact is unknown, consider other factors that may help determine the appropriate level of risk:

- How important is the potential impact in context of other issues your government is currently managing?
- If the probability of the impact is unknown but you assume it increases, how problematic would that increase be for systems in your planning areas?

- If the projected impact exacerbates current or existing stresses to systems in your planning areas, how effectively is your government currently handling the stresses?
- What is the adaptive capacity associated with systems in that planning area?

These and other questions can help you make a preliminary estimate of risk when the consequence and/or probability of a projected climate change impact are unknown.

2. Planning Area	**3. Current and Expected Stresses to Systems in This Planning Area**	**7. Projected Climate Change Impacts to Systems in This Planning Area**	**RISK ANALYSIS**		
			13. Consequence of Impact (high, medium, low)	**14. Probability of Impact** (high, medium, low, unknown)	**15 . Estimated Risk to Systems in This Planning Area** (high, medium, low)
Water supply	More summer drought	More drought, summer water stress likely due to lower winter snowpack and warmer, drier summers. Population growth will compound this problem.	High – threat to public safety, loss in consumer confidence, lost revenue. Affects entire customer base.	High – already a concern and warmer, drier conditions expected.	High
Stormwater management	Combined sewer overflows (CSOs)	More localized flooding, water quality problems possible if precipitation becomes more intense, frequent.	Medium – contributes to water quality degradation, potential health, and ecosystem impacts. Affects combined sanitary/storm sewer piping in about 30% of the city.	Unknown at the regional level, but issue is already a major management concern and more intense precipitation observed since 1973.	Medium
Road operations and maintenance	Pavement buckling on asphalt roads during extreme heat events	More required asphalt maintenance likely.	Medium – potential implications for public safety, higher road maintenance costs, travel restrictions for heavy loads. Affects about 55% of the city's medium and high volume roadways.	High – warmer summer temperatures expected.	Medium-high

Table 9.1 – Qualitative risk assessment for systems associated with the sample planning areas of water supply, stormwater management, and road operations and maintenance. This table provides an example of a qualitative risk assessment for systems associated with the sample planning areas of water supply, stormwater management, and road operations and maintenance.

9.2 Establish Your List of Priority Planning Areas

After conducting your vulnerability and risk assessments for systems in your planning areas, you are now ready to identify your ***priority planning areas*** – or planning areas of particular importance to your community or government which are vulnerable to climate change impacts. From this point forward, your climate change preparedness efforts should focus on priority planning areas.

PRIORITY PLANNING AREAS are the planning areas which your community or government determine to be most important given your community's vulnerabilities to climate change and the associated risks.

As public decision-makers, you may already be generating ideas for how to reduce the climate change vulnerabilities and risks you have identified, and you may even be embedding cost-benefit evaluations in your thinking. However, at this stage of problem definition, we encourage you to refrain from formally proposing or prioritizing your possible actions yet, and simply focus on ranking the problems you face – in the form of a list of priority planning areas. In Chapter 10, we will provide more specific guidance on how to evaluate costs and benefits of individual preparedness actions in light of the other priorities of your government.

To identify your priority planning areas, group the results of your vulnerability assessment (Table 8.4) and your risk assessment into one of the following general categories of systems: high risk/high vulnerability, high risk/low vulnerability, low risk/high vulnerability, and low risk/low vulnerability. As illustrated in the vulnerability-risk matrix in Figure 9.1 you will want to make planning areas that have high-risk and high-vulnerability systems a priority.

How to prioritize planning areas that are *not* high-risk and high-vulnerability is up to your team. This decision will likely depend on a mix of criteria not explicitly captured in the vulnerability and risk assessment process, including considerations such as values, economic drivers, and other factors unique to a given community. Examples include:

- **Existing community government priorities.** For example, your administration may already be committed to reducing the risk of forest fires in adjoining forest lands. This effort may make preparedness planning in forest resources a higher priority over other planning areas.
- **Unique planning or funding opportunities.** Examples of unique opportunities include: one-time-only state grants for addressing coastal zoning planning, and plans to make significant upgrades to the community's stormwater collection system. These windows of opportunity may influence the decision to prioritize a planning area that would not otherwise have been chosen.

As illustrations, some of King County's climate change priority planning areas are: public health and emergency preparedness, water supply and streamflow management, coastal hazards management, and flood hazard management.

Figure 9.1 Sample Vulnerability-risk Matrix for Identifying Priority Planning Areas

PLANNING AREAS WITH SYSTEMS THAT ARE...

	Low Vulnerability	High Vulnerability
High Risk	***May be** priority planning areas*	***Should be** priority planning areas*
Low Risk	***Are unlikely to be** priority planning areas*	***May be** priority planning areas*

Remember that risk will change over time. New information on climate change and climate impacts will become available, allowing for better quantification of risks. Non-climatic factors like population growth will also place additional demands on government services and ecosystems, compounding the risk associated with climate change impacts. Climate change itself may shift the consequence, probability and magnitude (and therefore risk) of any particular event. Finally, preparedness planning itself may reduce risk associated with specific climate change impacts. For these reasons, periodically re-evaluate your risk assessment and selection of priority planning areas to make sure the priorities still reflect your community's needs.

***Checkpoint:** Upon completing this section, you should have a list of one or more priority planning areas identified. These priority planning areas will be the focus for your preparedness actions and long-term preparedness plan.*
