

# Leveraging Risk Management to Improve Business Performance

Roopchan Lutchman P.Eng, PMP, GHD Advisory

## Summary

Risk is defined as the management of the impact of uncertainty on business objectives and is a key concept that every manager needs to fully understand and practice. A comprehensive risk management framework should be established at the corporate level in an organisation to address all potential risks to the business. Consequence criteria (or impact of the threat on the business objectives or sometimes referred to as criticality) provides the consistency for doing risk analysis and should be based on triple bottom line objectives: social, economic and environmental. An organization should follow standard risk management steps (e.g. ISO 31000) and based on the operating context conduct risk Identification, Analysis, Evaluation, Treatment and Monitoring/Control. A consistent approach to risk management (and defined appetite for risk) across the organisation can create significant value in the areas of reliable service or production, reduced critical asset failures, health, safety and environmental issues as well as better allocation of scarce resources. Effective risk management allows for evidence based decision making and provides sound rationale for prioritization of capital and operating funds. It also allows decision makers to better understand the risks and associated costs that they tolerate. This paper presents a risk management approach based on the ISO 31000 standard and provides insights on more advanced approaches (AWWA J-100 and the Bowtie Technique) with a supporting case study from an asset management perspective.

## Keywords

Risk Framework, Threat Events, Probability of Failure, Consequence of Failures, Criticality, Vulnerability, Resilience, Risk Treatment, Risk Appetite, Bowtie

## COMPREHENSIVE RISK MANAGEMENT

Businesses on a daily basis try to juggle the Level of Service (LOS) or Level of Production, Cost of Service (COS) or Production, and Risk (See Figure I). When too much risk is being tolerated, major events can have significant impacts to the business that can lead to catastrophic outcomes such as bankruptcy. Being too risk adverse can also drive up costs and reduce profitability. Successful businesses try to find the right balance of these three elements. LOS and COS are fairly straightforward to define, Risk however, is a more difficult proposition since risk is generally esoteric considered to be very subjective.

Risk management has traditionally been associated with the financial investment world and in other areas such as safety and project delivery. For many years decision makers managed risks the old fashioned way – gut feel and intuition. The experienced managers eventually built up enough skills in this area that they became good at taking risks. However, this knowledge is not easily passed on to other staff and creates a “risk” to the organization when they move on. As resources become more limited, gut feel and intuition are not sufficient to inform complex decisions. A more comprehensive approach to risk management is needed and it starts by understanding the various type of risks businesses face. There are many categories of risk <sup>[1]</sup> that impact an organisation, these include Business, Project Management, Health & Safety, Physical Asset and Operational Risks with associated decreasing business impacts (Figure II). These are discussed below:

**Corporate Business Risks** - this focuses on major events that can seriously limit an organization’s ability to meet its strategic objectives. These can include natural events, terrorism, systematic risks and major power failures (e.g. the 9/11 attacks on the World Trade Centre in New York in 2001, the Global Financial Crisis and the collapse of the Lehman Brothers

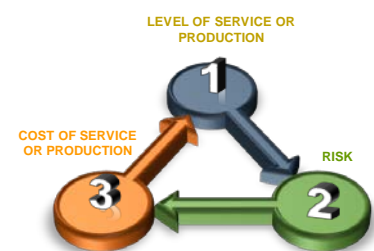


Figure I Balancing Risk, COs, LOS



Figure II Types of Risks

in 2008). Effective risk management in this area leads to the development of Business Continuity Plans.

**Project Management Risks** – when projects go wrong the consequences can be very serious from financial losses, violations of regulations and social impacts. Managing risks is a core element of effective project delivery to achieve project objectives. A new component of project risk is the focus on design of infrastructure. Trying to correct issues after assets have been installed and operational can be difficult and risk mitigation options can be costly. Proactive risk management can however be considered upfront in the asset lifecycle through use of the Reliability Centered Design technique. This ensures improved reliability, maintainability and operability of assets.

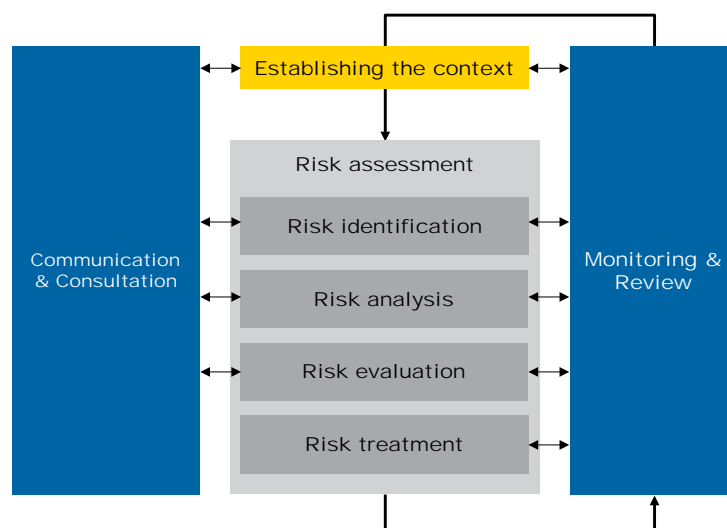
**Health and Safety Risks** – understanding the potential threats, likelihood that they can occur and the impact to health & safety is essential to capital delivery, operations and maintenance practices. Rigorous risk management should be implemented in this area eliminate injuries, or fatalities to staff / stakeholders as well as damage to assets.

**Physical Asset Risks** – this considers the likelihood that an asset (usually a major asset class such as a lift station) can fail and the impact on levels of service. This analysis can lead to the development of risk mitigation plans that will inform the capital planning process as well as operations and maintenance. At the component level, risk management can focus on the various functions and failure modes of the individual components (e.g. a pump or motor) that can fail and the impact when it does. The output would be the right maintenance tactic to maximize reliability and extend the useful life of an asset.

**Operational or Process Risk** – this focuses on the likelihood that a process (e.g. water system) can be contaminated and the consequences (effects) on its customers. A Drinking Water Quality Management System is an example of how utilities have been managing this risk.

## THE STANDARD RISK MANAGEMENT FRAMEWORK

The ISO 31000 Risk Management Standard (Figure III below) clearly lays out the complete risk process. It prescribes to first establish the risk context (e.g. the scope of the risk assessment), identifying the potential threat (e.g. a terrorist event, an earthquake etc.), conducting the risk analysis using the risk equation (below), and treatment of the risk (e.g. mitigation strategies, accepting, or transferring the risk). Risk management is not a one off activity, it require ongoing monitoring and review as new threats are identified, likelihoods and consequences change or risk treatments have been completed and there is revised risk profile. Ongoing consultation and communication are essential to a successful risk program.



**Figure III – ISO 31000 Risk Management Framework**

The Risk equation (below) helps to quantify subjective data and create a quantitative risk score that can be prioritized for further evaluation and risk treatment.

$$\text{Risk} = | \text{Threat Likelihood (L)} | \times | \text{Consequence (C)} |$$

The likelihood of a threat event occurring resulting a failure can be quantified as (example descriptors are also provided below):

1. Rare - An occurrence /situation is not likely to occur within 20 years

2. Unlikely - An occurrence / situation is not likely to occur within 10 years but possibly within 20 years
3. Possible - An occurrence / situation might occur within 10 years
4. Likely - An occurrence / situation might occur within 2 years
5. Almost certain - An occurrence / situation that is happening or imminent and / or will probably occur within 1 year

Consequence of a threat occurring can also be rated as follows (this examples focuses on descriptors for impact on the environment. Similar descriptors can be defined for social and economic impacts):

1. Negligible – Very negligible impact, reversible within 1 week
2. Low - Material damage / improvements of local importance, minor, short term (within 6 months) very isolated damage / improvements to the environment
3. Moderate - Significant short term (less than 1 year) local damage / improvements to the environment
4. Severe - Significant long term (greater than 1 year) widespread damage / improvements to the environment
5. Catastrophic - Major long term (greater than 5 years) or permanent widespread damage / improvements to the environment

Using the above approach it is now possible to create a risk map (Figure IV) showing the individual scores for the system, process or asset being evaluated. The risk scores can be categorized based on consistent system and together with the organization's "appetite" for risk provide a basis for risk treatment options. Risk treatment options can vary from engineering capital projects, improvement in operations and maintenance practices, emergency preparedness plans, additional insurance etc. Appetite for risk is really an attempt to define the level of tolerance that the organisation has for risk. The red line in Figure IV below is an example for a major utility. All assets that have a risk score above the line need to have a risk treatment plan with approved funding to bring the risk below the line to a more tolerable level.

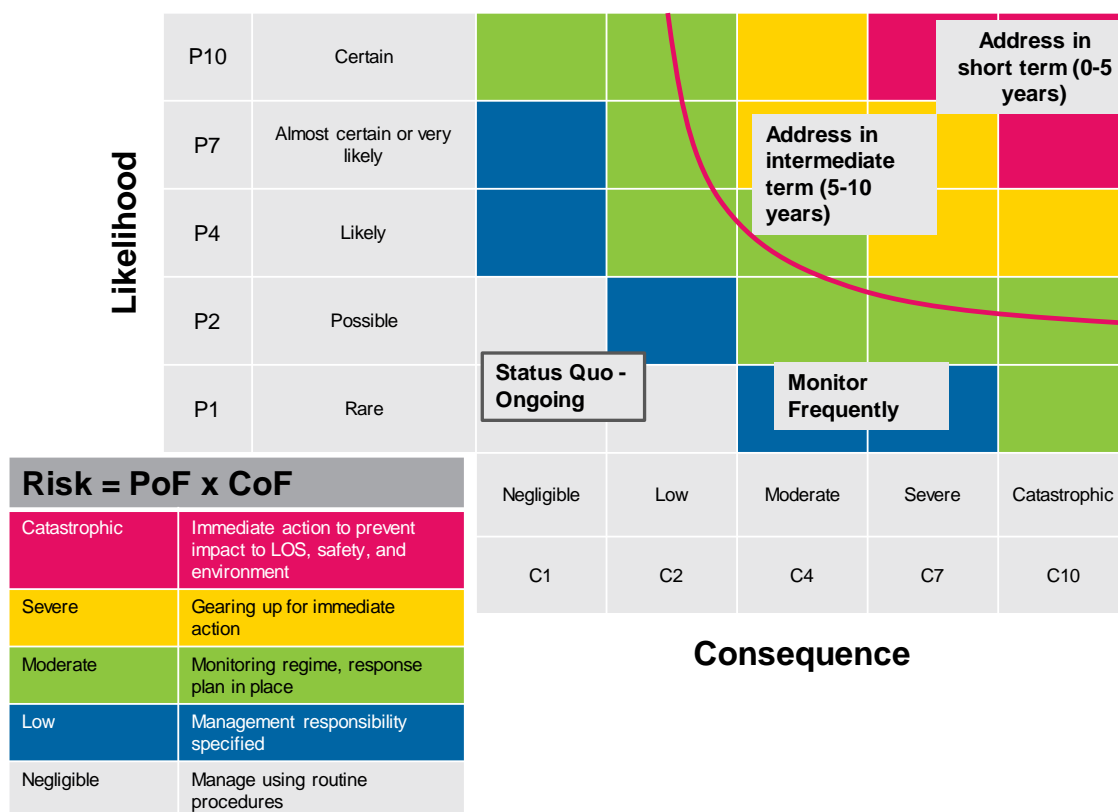


Figure IV Risk Mitigation and Risk Appetite

## THE AWWA RAMCAP J100 RISK PROCESS

This is more sophisticated approach to risk management and adds two discounts factors to the risk equation:

$$\text{Risk} = | \text{Threat Likelihood (L)} \times \text{Vulnerability} | \times | \text{Consequence (C)} \times \text{Resilience} |$$

1. **Vulnerability** – is a measure of how vulnerable the system, process or asset is to the threat and can be used to discount the likelihood of the threat event occurring. An example of this is water pipes that are installed in a lined tunnel may be less vulnerable to an earthquake threat.

2. **Resilience** – is a measure of how easy it is to restore service after the threat happens and a failure occurs. An example of this is failure of a large water main where there is high resiliency and the leak can be isolated and service restored through another pressure zone.

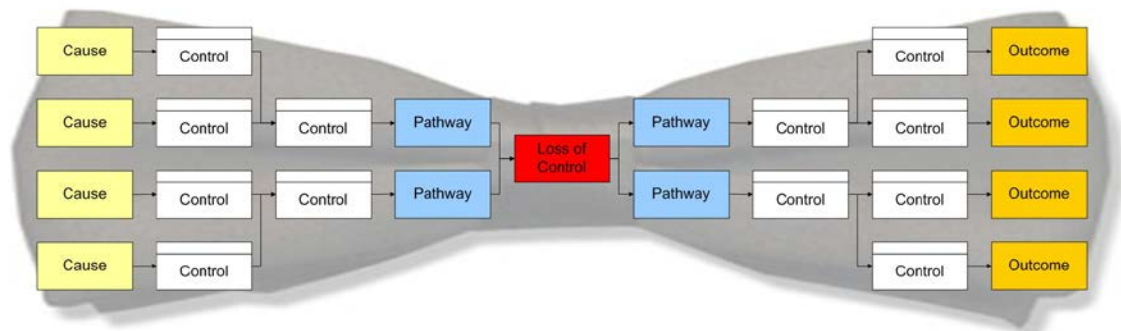
This standard follows a step by step detailed seven-step process (along the lines of the ISO 31000 standard) to develop the risk score and treatment options. These steps are detailed in Figure V below:



**Figure V – AWWA RAMCAP J100 Risk Process**

## THE BOWTIE TECHNIQUE FOR RISK MANAGEMENT <sup>[2]</sup>

The Bowtie technique is a simple graphical technique for portraying cause-consequence relationships. It is often used in health and safety task analysis, industrial design and risk analysis for high reliability control systems. It allows systems to be represented in a way that allows for multiple causal interactions, without any one cause-consequence relationship dominating. The bowtie diagram shows many interacting causes and consequences, forming a rich picture of a scenario, which is often helpful in the early stages of design and analysis. A basic Bowtie format is shown below in Figure VI demonstrating the risk evaluation of a loss of control situation. The bowtie situates a critical event at the center of the bowtie (in this case a 'loss of control', as this bowtie is being used for risk-based design). This critical event is then used to elicit upstream (preceding) causes, which are displayed on the left side. Consequential impacts or outcomes are shown downstream, on the right side. The resulting picture is a scenario map, showing multiple interacting scenarios that detail the narrative underpinning the central, critical event. The narrative time flow is from left to right. In Figure VI, you can imagine that the central red critical event is, for example, 'fall off a bicycle', in which case some of the causes on the left may be: a slippery road; hit obstacle; brakes fail, and/or swerve to avoid car. The outcomes on the right may then be: personal injury; damage to bike; late for work, and/or altercation with car driver. The individual causal factors (road condition, traffic behavior, mechanical failure) may act together and increase the chance of falling from a bike, and in turn the consequential impacts.



**Figure VI Bowtie Risk Management Technique**

## CASE STUDY – REGION OF PEEL

Regional Municipality of Peel through its growth projections will be tasked with supplying over 2.5 million residential and commercial customers with a reliable and high quality supply of drinking water over the next twenty (20) years. In response to this, and building on its commitment to provide high levels of municipal services, the Region has undertaken a review of its linear infrastructure to ensure it can continue to deliver water and wastewater services that meet its customer's needs. The Region decided to look at this linear infrastructure through the risk management lens instead of a reactive approach to identifying projects. The project leveraged the AWWA J-100 risk management framework in order to understand and proactively manage threats and opportunities to the Region's municipal services. A detailed risk map (Figure VII) and a risk management plan has been developed with an emphasis on optimizing Region resources together with benefits and costs. Existing and planned protective measures were used to generate alternative options for managing critical asset risks. Risk mitigation options included repair, rehabilitation, replacement, adding redundancy and other operational procedures. The Region has been able to demonstrate benefits in the form of deferred capital costs.

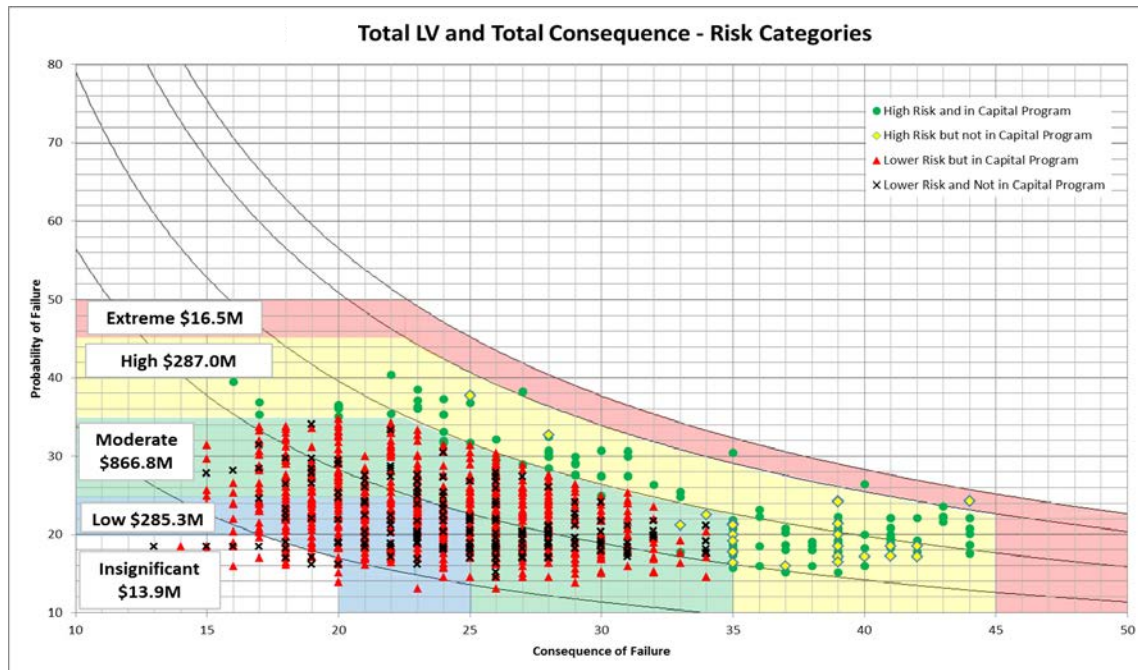


Figure VII Risk Map for Water Pipes (Region of Peel)

## CONCLUSION

Risk is defined as the management of the impact of uncertainty on business objectives and is a key concept for staff throughout the organisation to understand and practice. A comprehensive risk management framework can be used to find the right balance of Level of Service (LOS) or Level of Production, Cost of Service (COS) or Production, and Risk for an organisation. There are many categories of risk that impact an organisation, these include Business, Project Management, Health & Safety, Physical Asset and Operational Risks. There are basic (the simple risk equation based on the ISO 31000 Standard) and advanced techniques (AWWA J100 and Bowtie) to evaluate and treat potential risks. A consistent approach to risk management (and defined appetite for risk) across the organisation can create significant value in the areas of reliable service or production, reduced critical asset failures, health, safety and environmental issues as well as better allocation of scarce funds. Effective risk management allows for evidence based decision making and provides sound rationale for prioritization of capital and operating funds. It also allows decision makers to better understand the risks and associated costs that they tolerate.

## REFERENCES

- [1] Roopchan Lutchman, *Sustainable Asset Management*, 2006, DESTech Publishers, ISBN 1-932078-47-9
- [2] Andrew Mark, *Travel risk SFAIRP assessment: An analytic approach adopting bowtie and barrier thinking*, GHD Advisory, 2017

## BIBLIOGRAPHY

- ISO 31000 Risk Management Standard
- AWWA RAMCAP J100 Risk Management Process