



# INCORPORATING RISK INTO OPTIMIZED STRATEGIC INVESTMENT DECISIONS

Mackinac Bridge, Michigan, USA

## MARTIN GORDON

11<sup>th</sup> National Conference on Transportation Asset Management

# Agenda

- Risk – Initial Thoughts
- Strategic Decisions
- How To Allocate Funding With Risk
- Thoughts To Take Away



# RISK – INITIAL THOUGHTS

Kicking Horse Canyon Park Bridge, Canada



# Everyone is talking about it, rarely put it into practice

- Risk means different things to people.
- Risk is employed at an operational, tactical and strategic level
- The equation is familiar  $C * L = \text{Risk}$ , the challenge lies in the detail
- Makes for very few good practice examples, despite the interest.

# Risk Perception Factors

## **We over-estimate with**

- Dread
- Natural risks
- Children
- Novelty
- Publicity
- It directly affecting me
- When we don't trust the messenger

## **We under-estimate when**

- We have some control
- It is human-made risk
- We have choices
- There is a risk benefit trade-off
- When we trust the messenger

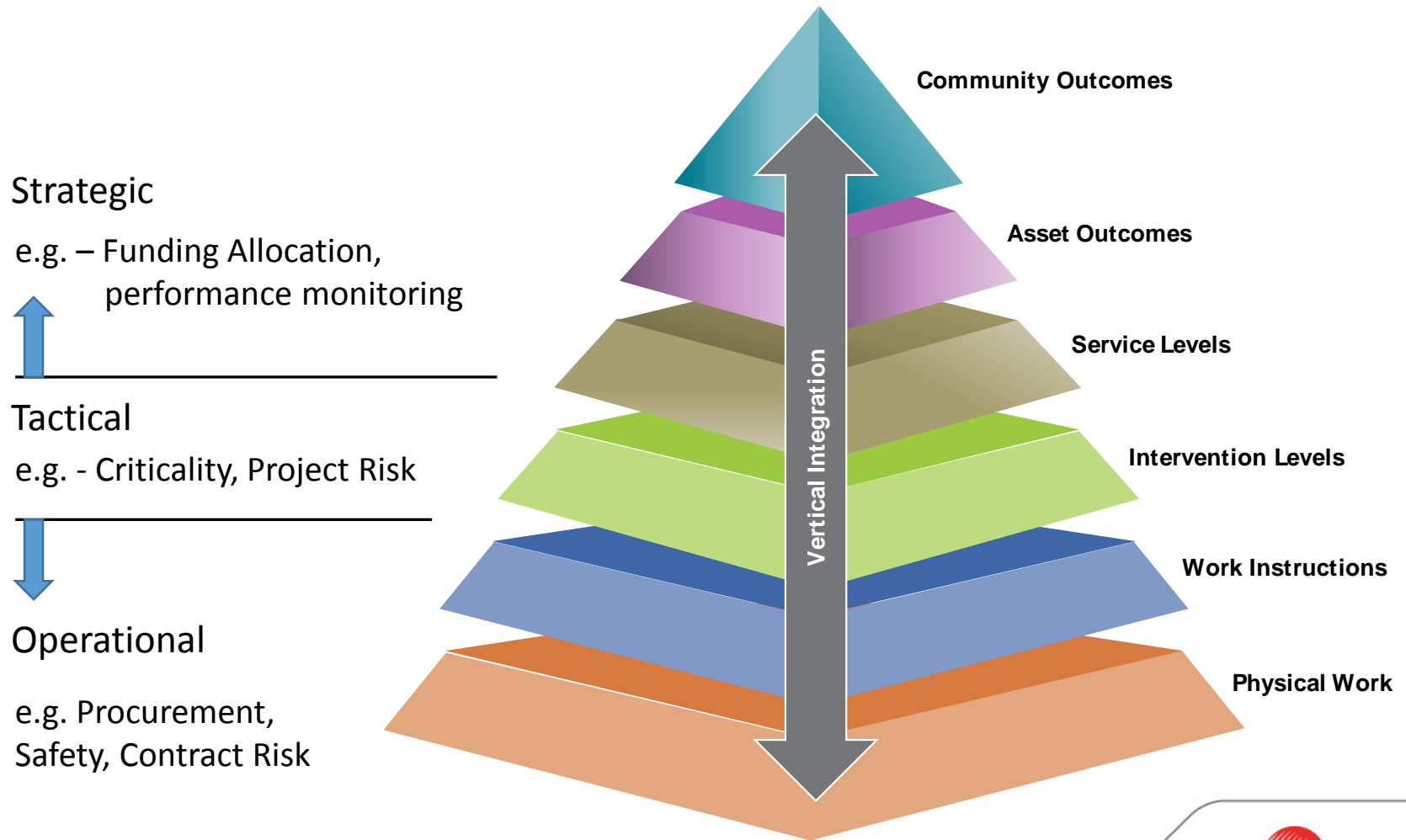


# The Problem

How to allocate funds across multiple service areas and infrastructure portfolios?



# Risk Has Utility at Multiple Levels





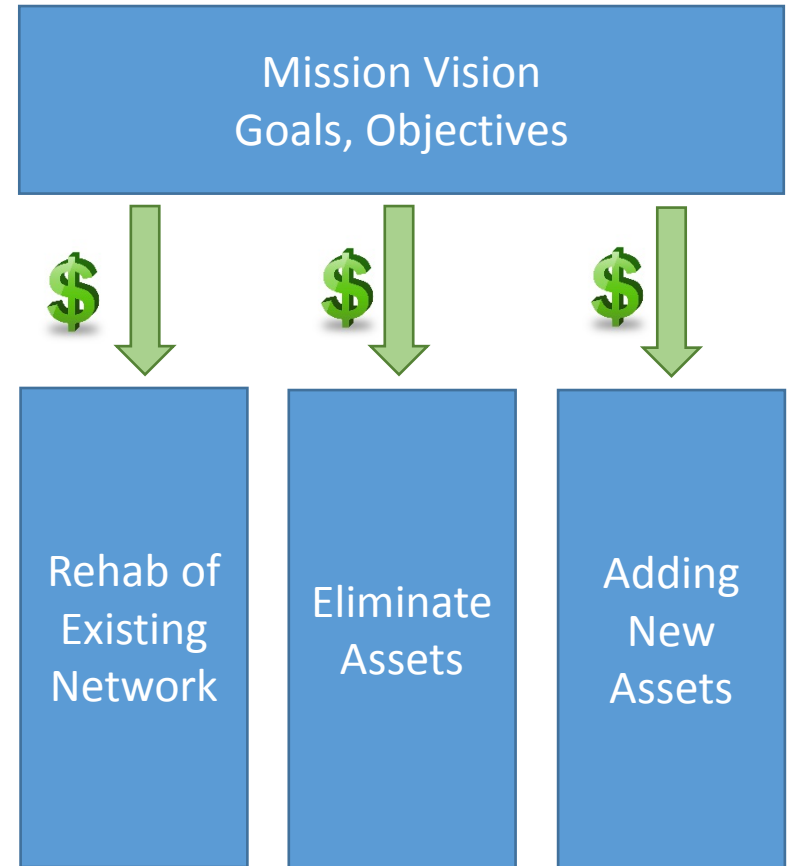
# STRATEGIC DECISIONS

Panmure Station, Auckland, New Zealand



# Investment Decisions for Infrastructure

- Alignment with goals and objectives of the agency
- Funding allocation in each bucket can be challenging
- Elected officials and decision-makers often don't respond to the technical language well enough to get the allocation right



# Example: Triple Bottom Line

- Multi-Criteria Analysis to assess investment alternatives
- Assess infrastructure investments alignment to agency goals
- Transparent, objective, and allows for an assessment of different asset types
- Weightings and criteria can change as the priorities of government change.

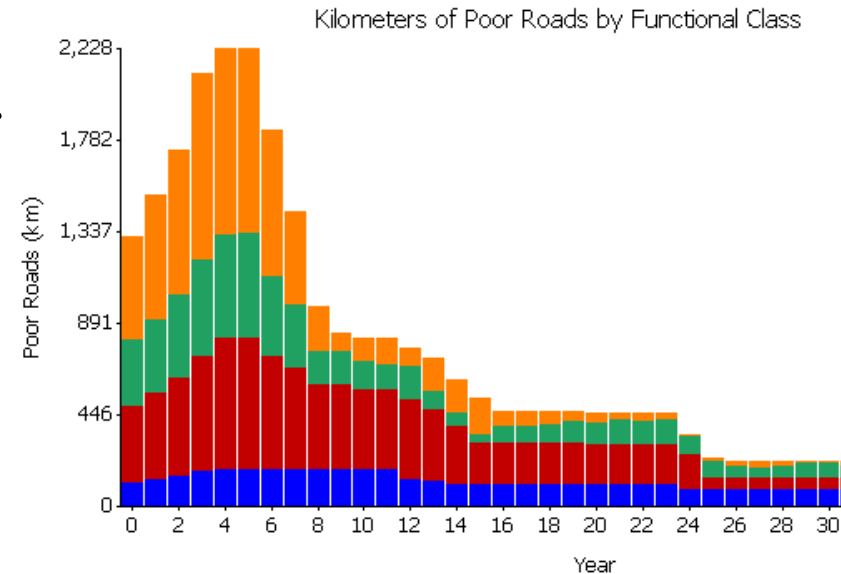
QBL	Provincial Objectives	Criteria	Indicator Weight*	Indicators
Economic (Wt = 50)	Stronger Economy (Wt = 26)	Job Creation	7	Jobs created after construction
			5	Regional unemployment rates
		Foster Private Sector Business Growth	8	Impact on transportation costs to input and output markets (i.e. labour, supplier, and customer markets).
		Supports Economic Development Plans	6	Level of support for initiatives in provincial economic development plans
	Living Within Our Means (Wt = 24)	Effective Service Delivery	8	Infrastructure provides the required capacity to meet present and future needs at acceptable levels of service
			8	Impact on network operating, maintenance, and rehabilitation costs
		Maximizes Leveraging Opportunities	8	Potential for sharing infrastructure costs with a public or private sector partner
Environment (Wt = 18)		Mitigate risks of climate change	8	Resilience to severe climate events
		Environmental Impacts	5	Impact on GHG emissions
			5	Other environmental impacts
Social (Wt = 22)	Enhanced Quality of Life (Wt = 50)	Health and Safety Impacts	10	Impact on risk of a casualty collision (i.e. injury or fatal collision)
		Access to services that meet primary needs	5	Impact on access to emergency services
			4	Impact on access to non-emergency services (i.e. work, shelter, food, education, health, etc.)
		Supported by community plans	3	Level of local community support
Cultural (Wt = 10)		First Nations	5	Impact on First Nations lands, culture, or community
		Preserves or Enhances Heritage Resources	5	Impact on heritage resources

\* Preliminary weights developed by DTI Project Team. Weights should be reviewed periodically.



# Renewal Decision-Making

- Agencies use a variety of analytics for renewal decisions
- Typically a variety of investment / treatment types are considered
- Objectives can be varied to assess the impacts of different investment alternatives
  - Hold Budget, Hold Condition
  - Target State / Service Level



**Some clients starting to use risk as the primary objective function for strategic, long term funding allocation**

# HOW TO ALLOCATE FUNDING WITH RISK

Sea to Sky Highway, Canada





# Achieving Service Levels

- Roads exist to provide a service:
  - Mobility and Land Access
- Service levels are customer focussed
  - Travel time / delay
  - Safety
  - Reliability
  - Availability
  - Rideability / Comfort
- Technical proxies have predominated
  - IRI, SDI, BCI, Rut Depth

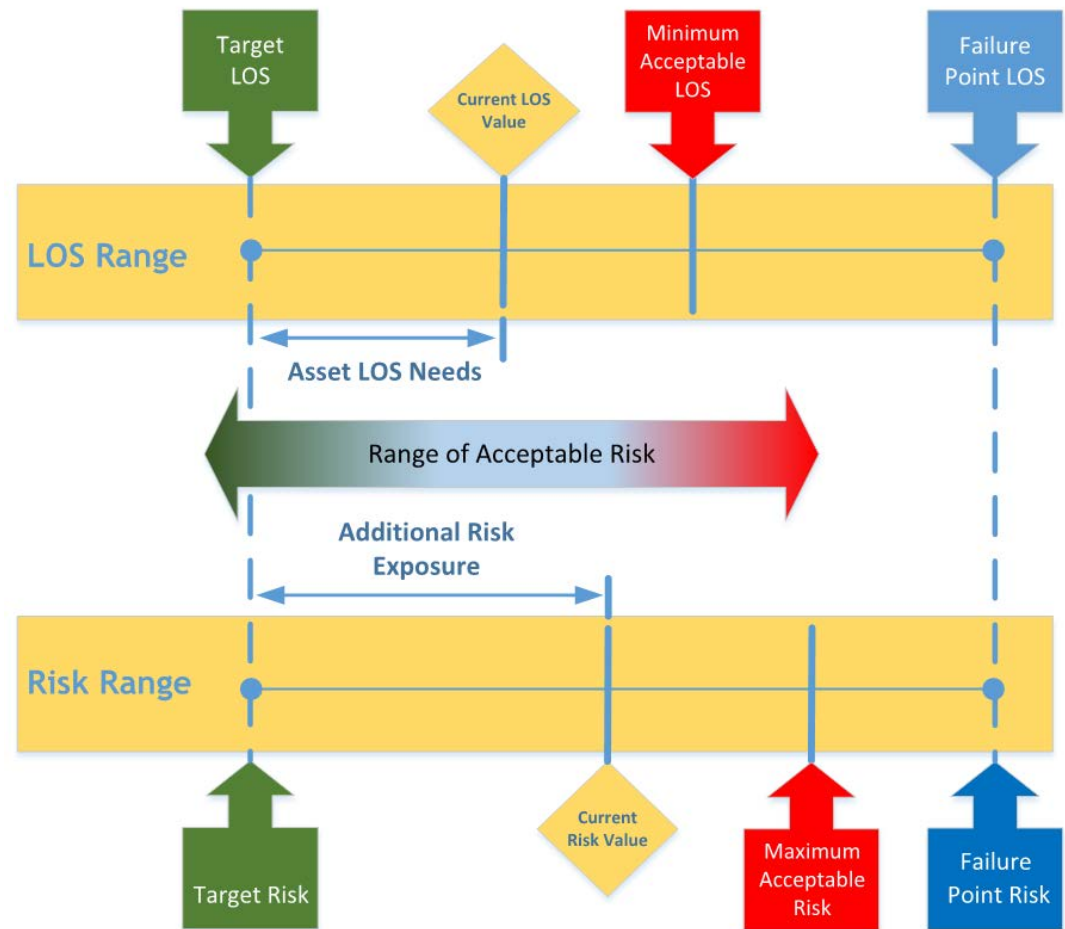
# Evolution of the Methodology

- Consequence is quantified as asset importance to agency goals, i.e. service level delivery failure's effect of achieving mandate
- TBL used to assess of importance of that asset and represent risk consequence / Performance Importance / a form of criticality linked to the degree of alignment to agency goals and objectives
- Condition used as a proxy for likelihood of failure, especially when actual probability is unknown
- In this way, a target risk level can be the objective function for investment analytics



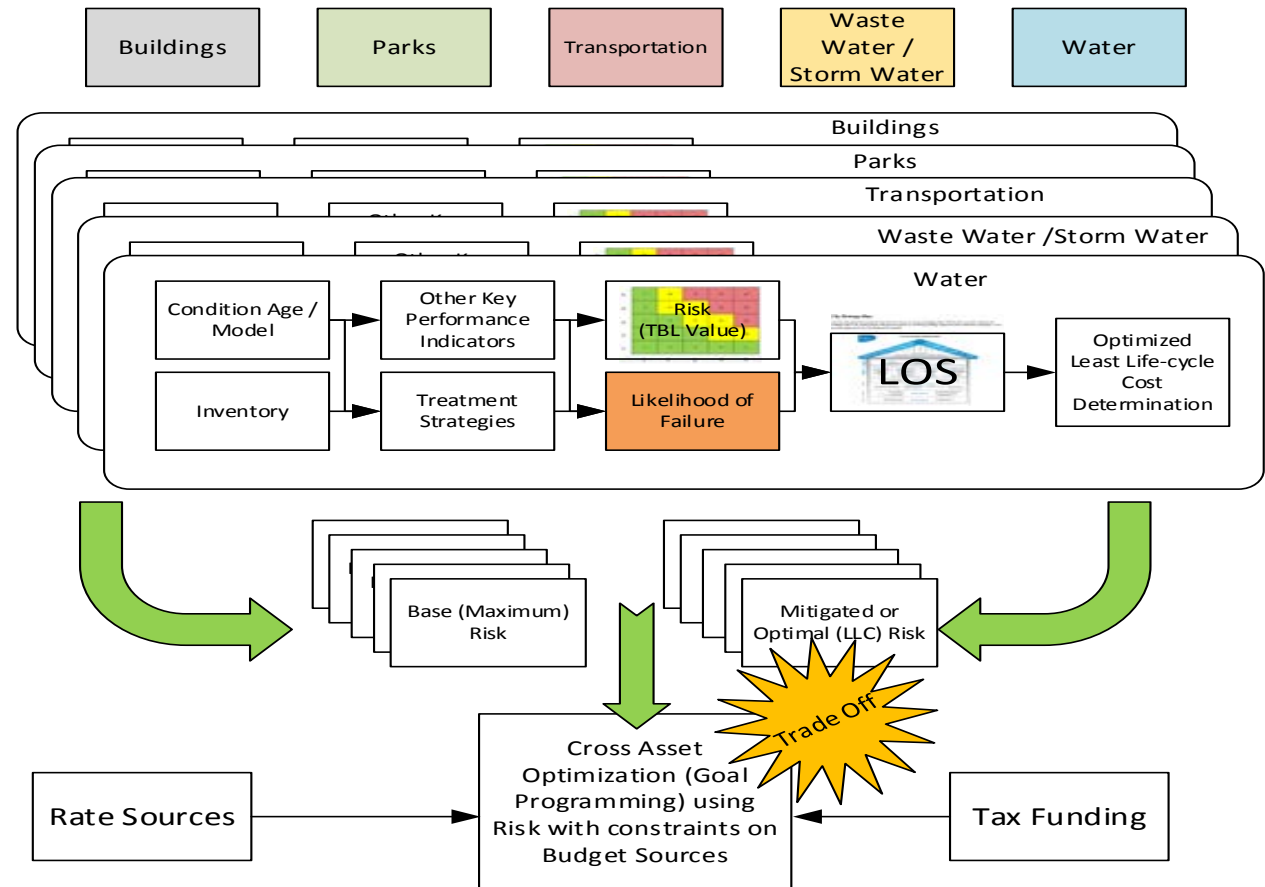
# Municipal Application

- Multiple services to deliver and asset portfolios
- Funding allocation between service/asset groups
- Mechanism hinges on risk levels being traded-off against investment



# Mechanism

- Model allocates funds incrementally to maximize **risk reduction benefit**
- Not necessarily the most risky
- Allocation to reduce risk as much as possible within constrained budgets, over time



# Benefits

- Politicians and decision makers respond to risk more readily, and actually are **more** worried about getting it wrong
- Provides common language to communicate and evaluate financial investment choices across very different assets / services
- “Consequence” / goal alignment is the most difficult aspect to consistently apply.
- Triple Bottom Line is the best way to evaluate portfolio assets relative importance

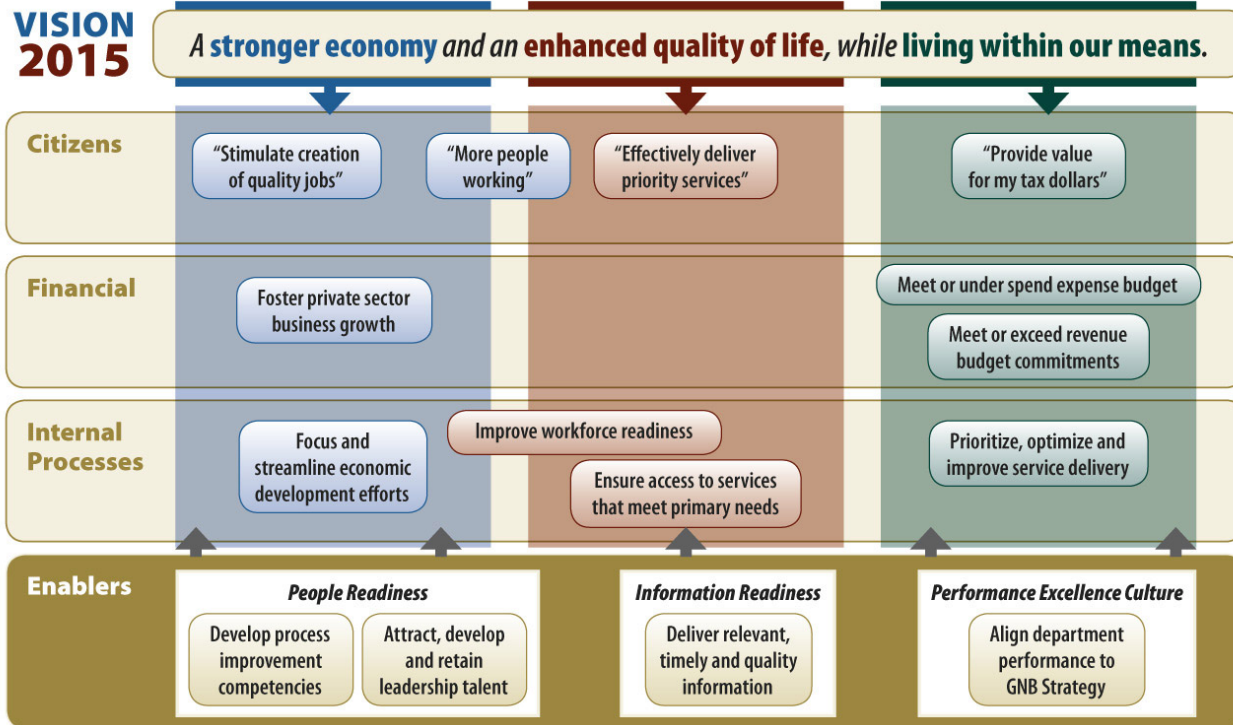


# How well does your organisation define it's goals and objectives?



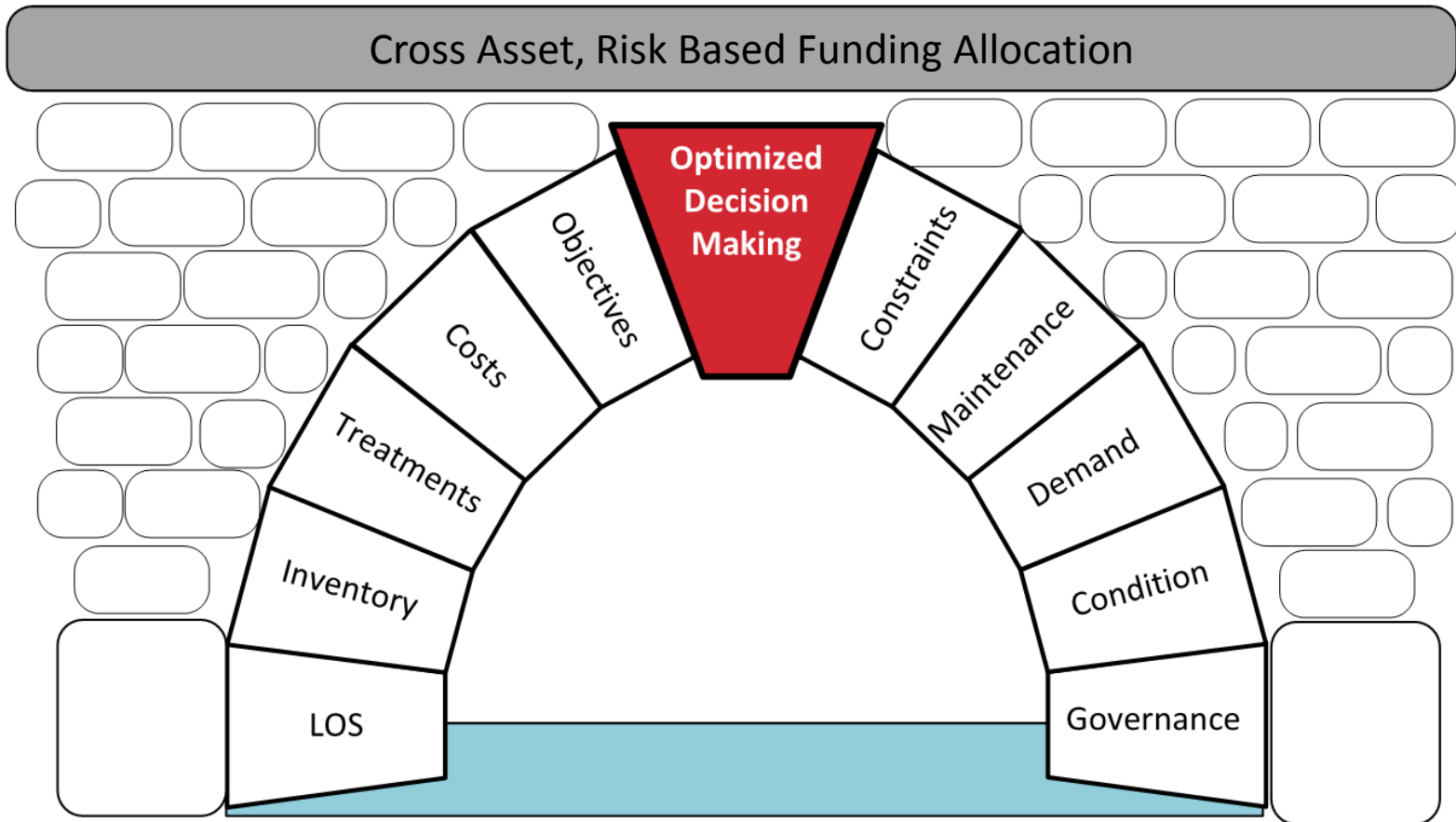
## Strategy Map | 2012 – 2013

Providing quality services to support a prosperous, fair and just society for New Brunswick.



NB PUBLIC SERVICE VALUES: COMPETENCE – IMPARTIALITY – INTEGRITY – RESPECT – SERVICE

# A few stones need to be laid before you can model risk in this way



# Thoughts to take away

- Risk can help allocate funds
- Method requires a good definition of agency goals and objectives that are translated to an objective MCA framework
- Optimized funding is important when funding is limited.
- Complex problems require powerful tools, ODM is a one you may have in your toolkit
- Build your foundation

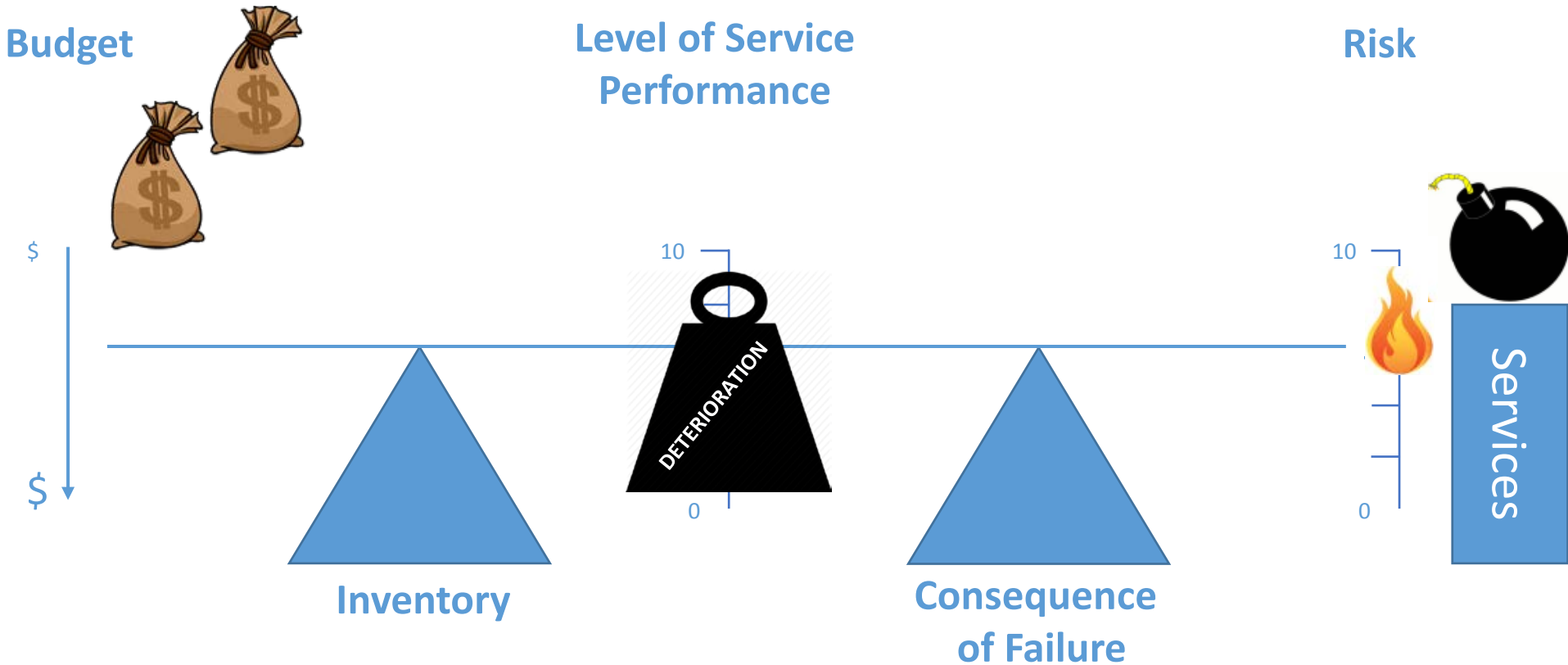


# QUESTIONS?

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# Balancing Delivery

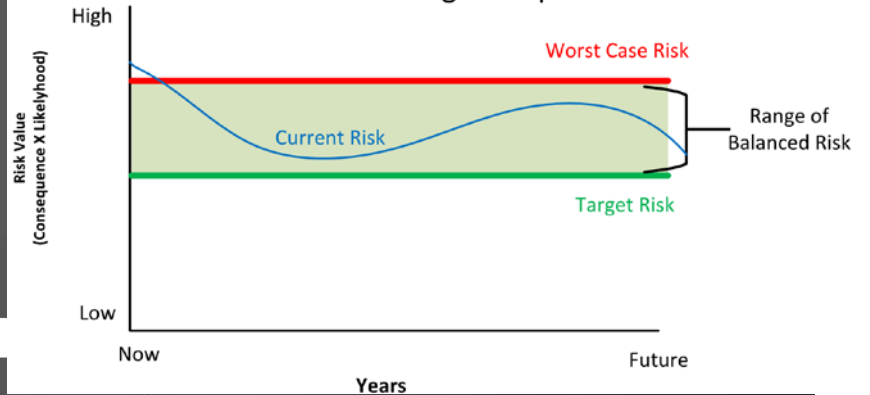


# Risk Example

## Roads Risk Profile



## Risk Balancing Example



## Watermains Risk Profile

