CLIMATE RISK INSTITUTE

COMMUNITY AND INFRASTRUCTURE RESILIENCE TO CLIMATE CHANGE

ROLE OF MUNICIPAL ENGINEERS

LAND ACKNOWLEDGEMENT

As treaty peoples, we all share a duty to respect and give care to the territories we live on, and honour the many treaties and agreements that govern the land. We must act in the understanding that we are bound by and accountable to our relationships as treaty peoples to each other and to the land, and commit to an ongoing process of learning and solidarity as the basis of these relationships.

From time immemorial, Indigenous nations have co-existed on these lands where we all now reside, forming relationships both among nations and with the lands and waters that support them and upholding treaties which continue to have importance to this day. As such, we acknowledge and respect the ancestors and current caretakers of these territories, as well as our individual responsibilities under all existing treaties.

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Advance Practice and Deliver Services

- Climate change risk assessment, adaptation planning, policy evaluation, and resiliency
- Previously known as the Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)

CRI Training Programs

- Infrastructure Resilience Professional (IRP) Certification Program
- Professional Planners Adaptation Training Program
- *Other sectors in the works (health, forestry).*
- Tailored group training available.

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MAIN MESSAGES

- You have two ‘climate jobs’.
- Integrate with what you’re already doing.
- Develop necessary skills.
- Be proactive rather than reactive.

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WEBINAR OUTLINE

Outline	Lead	Time
Introduction	Paul	5 mins
Climate Impacts and Infrastructure	Kirsten	10 mins
Tools and Approaches	Glenn	10 mins
Role of Engineers	Glenn	10 mins
Training and Professional Development	Paul	10 mins
Closing and Discussion	All	15 mins

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WE'RE NOT JUST MANAGING RISKS – WE'RE INVESTING IN RESILIENT COMMUNITIES.

COST

Investments

Construction
Operation
Financing
Reinvestment
Maintenance

BENEFIT

Reduced risk

Damaged assets
Business disruption
Traffic disruption
Mental stress
Lost income
Injuries & illness
Emergency response
Damaged inventory

CO-BENEFIT

Added value

Feeling of safety
Reduced cooling
Health
Recreation
Water quality
Education
Local economy
Aesthetics
Air quality
Social cohesion

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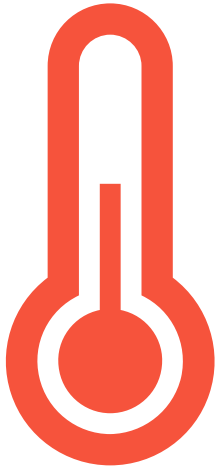
CLIMATE IMPACTS AND INFRASTRUCTURE

WHY?



Our climate is changing.

We cannot assume that the future will be the past.

We need the tools and skills to act urgently on climate change.

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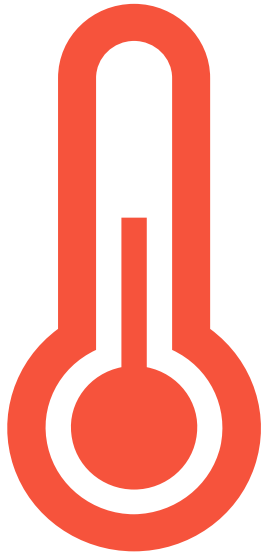

Our climate is changing.

The cumulative scientific evidence is **unequivocal**: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all.

IPCC 2022 WGII SPM.D.5.3.

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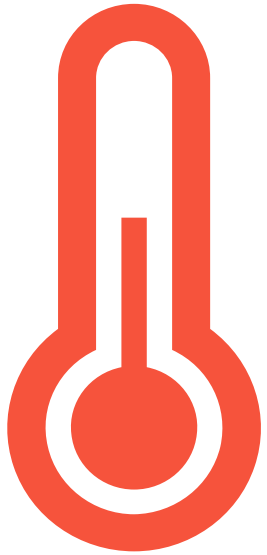

Our climate is changing.

North American cities and settlements have been affected by **increasing severity** and **frequency** of climate-induced hazards and extreme events, contributing to **cascading effects** of infrastructure damage, loss of services and economic activity, damage to heritage resources, safety concerns and disrupted livelihoods.

IPCC 2022 WGII North America Fact Sheet

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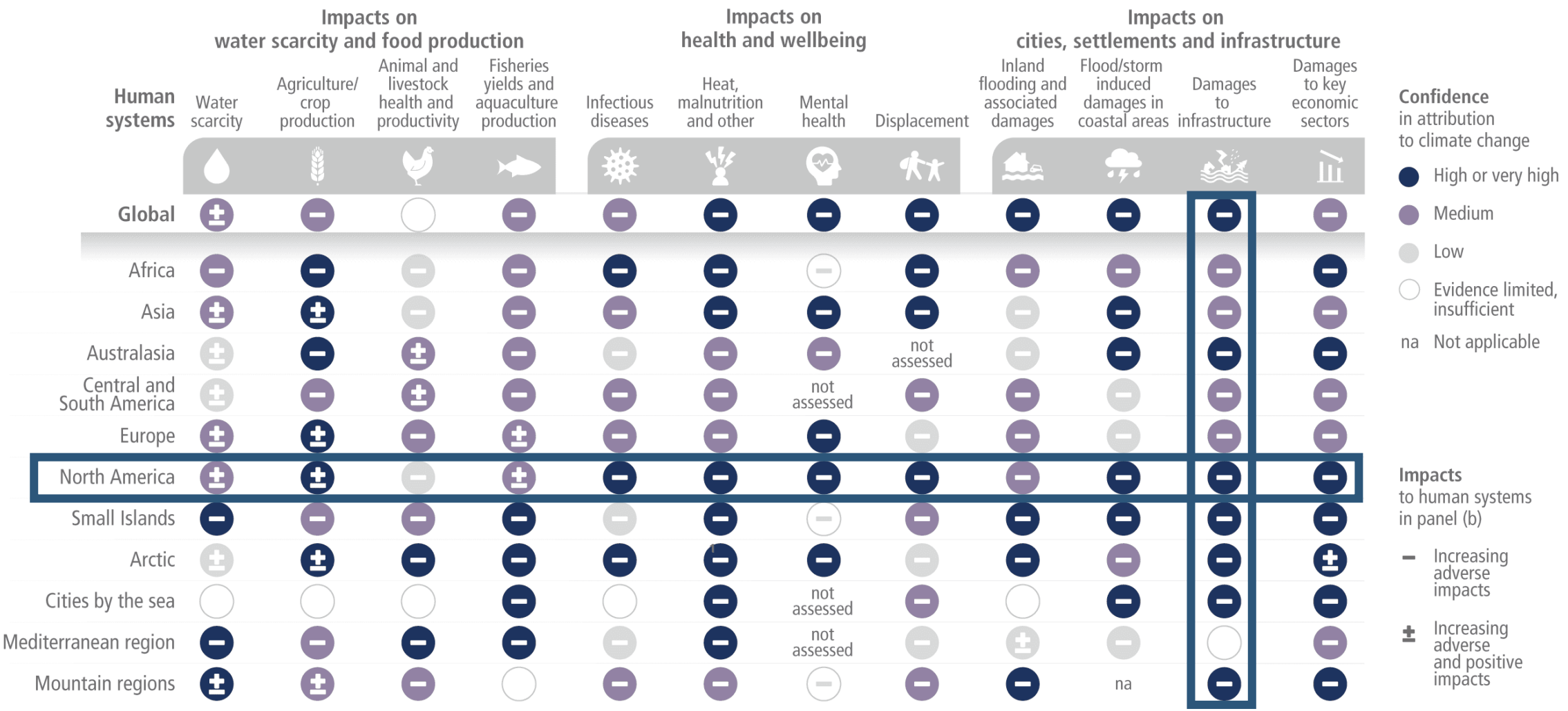
OBSERVED IMPACTS OF CLIMATE CHANGE ON HUMAN SYSTEMS



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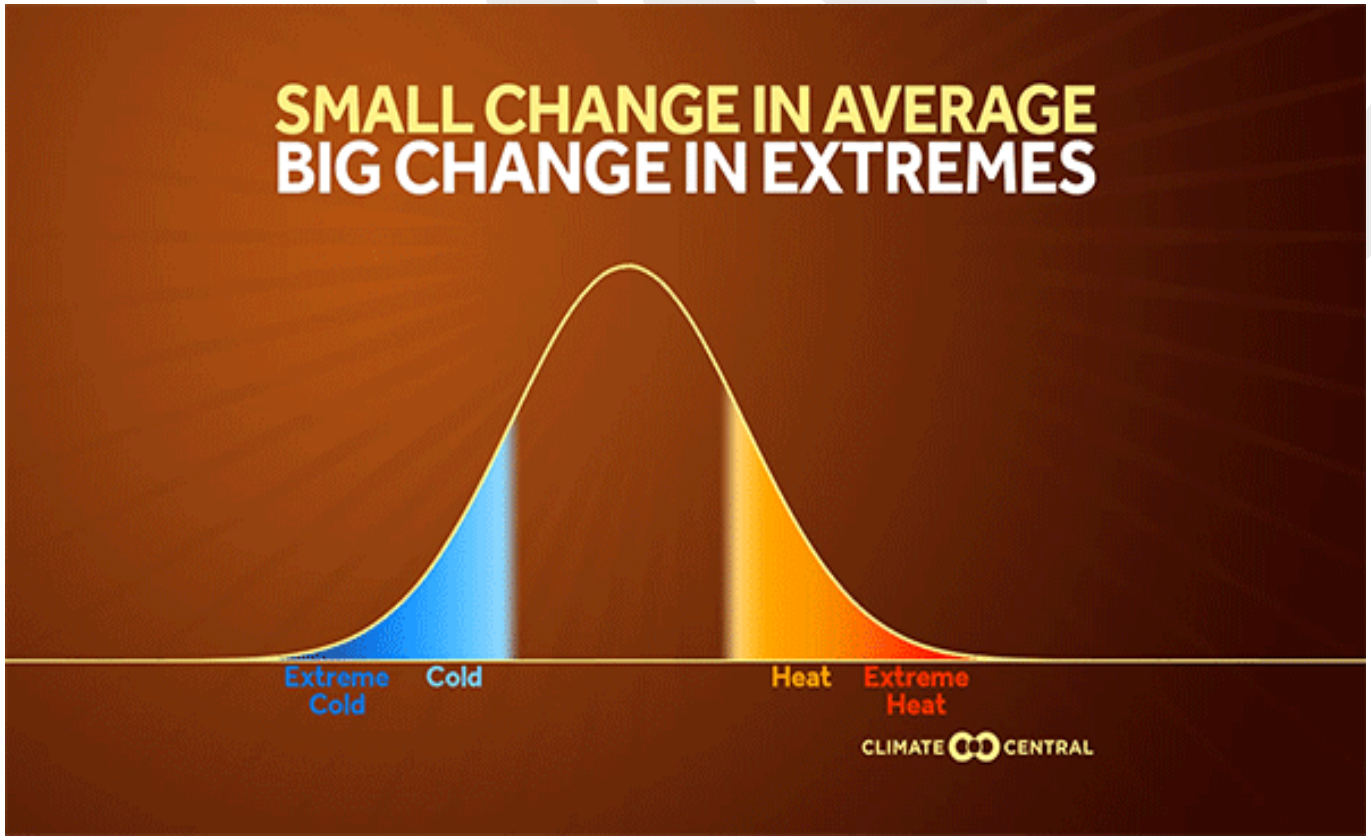

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IMPACTS OF CLIMATE CHANGE ON INFRASTRUCTURE

More Intense Rainfalls

Loss of assets; transportation delays; storm drainage issues; roof and windows leaking; flooded underground utilities and facilities; premature deterioration; water treatment and wastewater issues …

Severe Thunderstorms

Flooding; tornado risks; lightning and hail damages; power and communications outages; transportation delays and risks, safety, cost, maintenance …

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IMPACTS OF CLIMATE CHANGE ON INFRASTRUCTURE

Snow & Ice Storms

Safety and emergency risks, higher removal costs, transportation delays and risks, widespread power outages, building collapse risks, flooding, snow & ice loads, maintenance, ice shedding, access risks, use of more deicing agents …

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IMPACTS OF CLIMATE CHANGE ON INFRASTRUCTURE

Higher Temperatures

Damage to structures, roads, runways, and powerlines; HVAC issues; energy shifts and cooling demands; power outages; premature deterioration …

Weathering

Windows, cladding, and concrete deterioration; moisture, deicing agents, and other deterioration issues…

IMPACTS OF CLIMATE CHANGE ON INFRASTRUCTURE

Stronger Winds

Cladding, debris, windows, elevator, and structural safety; sway; power outages; maintenance; airport operations; emergencies; etc.

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We need the tools and skills to act urgently.

Adaptation measures reduce risks from climate impacts but efforts will be **overwhelmed** by increasingly extreme weather events unless combined with **aggressive mitigation efforts** to curb global warming.

IPCC 2022 WGII SPM

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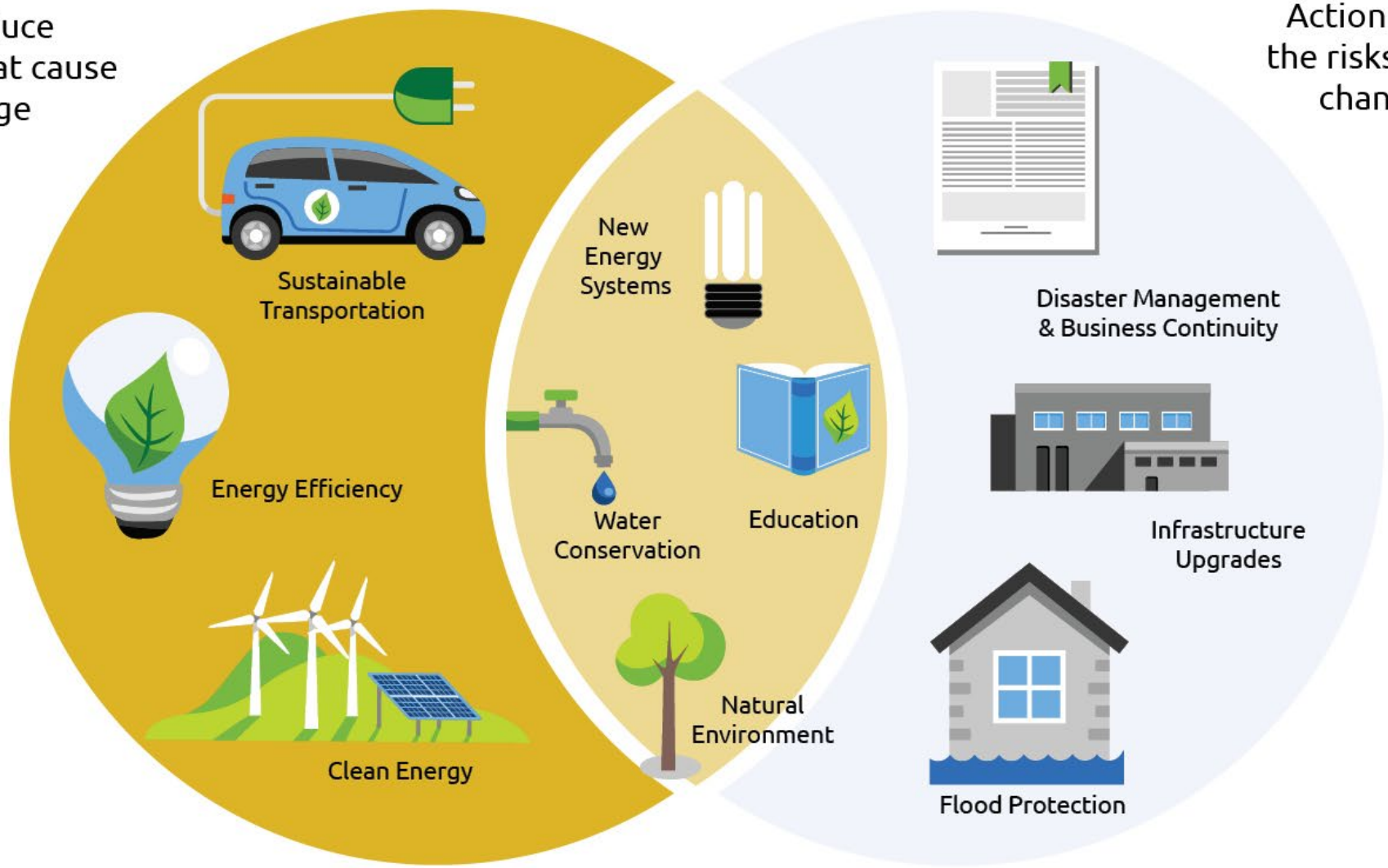
Mitigation

Action to reduce emissions that cause climate change

Adaptation

Action to manage the risks of climate change impacts



WHY ADAPT?

Investing **$1** in prevention results in avoided costs of…

$4	**$5**	**$6**	**$6**	**$40**
from investments in improved resilience	from governments' climate resilience investments	from hazard mitigation investments	from disaster mitigation investments	related to the (prevented!) 1997 Winnipeg flood alone
Source: Global Commission on Adaptation	**Source**: The Economist	**Source**: US National Institute of Building Sciences	**Source**: Federation of Canadian Municipalities	**Source**: Government of Manitoba

Courtesy, Tom Ewart, Cooperators Insurance

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TOOLS AND APPROACHES FOR RISK ASSESSMENT AND ADAPTATION

WHAT IS A CLIMATE RISK ASSESSMENT?

1. **Scopes** and identifies relevant existing and future climate conditions
2. **Characterizes** natural areas, sites and hazards
3. **Identifies** and **estimates** vulnerabilities and severity of consequences from a hazard occurring
4. **Recommends** actions to reduce climate risks and evaluates resilience opportunities

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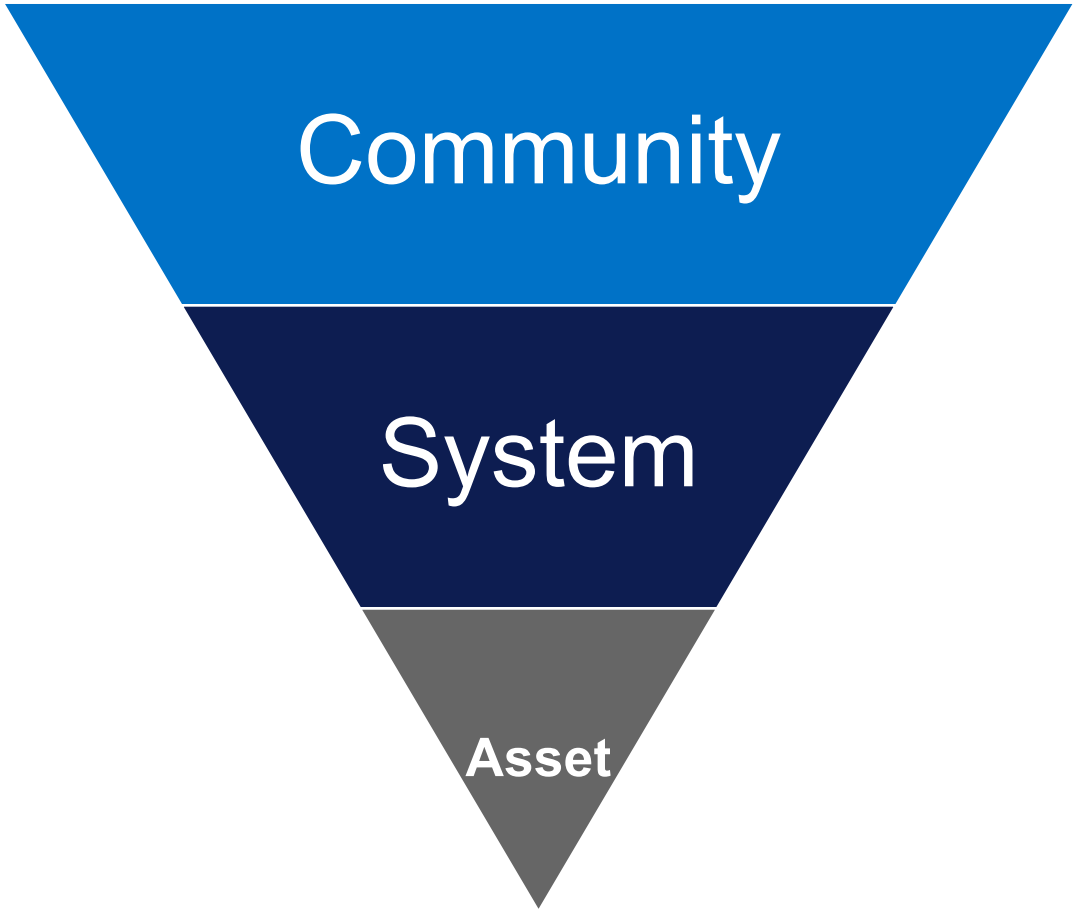
SCALES OF ASSESSMENT & EVOLVING FRAMEWORKS



Examples

ICLEI Local Governments for Sustainability

engineerscanada
ingénieurscanada
Public Infrastructure Engineering Vulnerability Committee (PIEVC)

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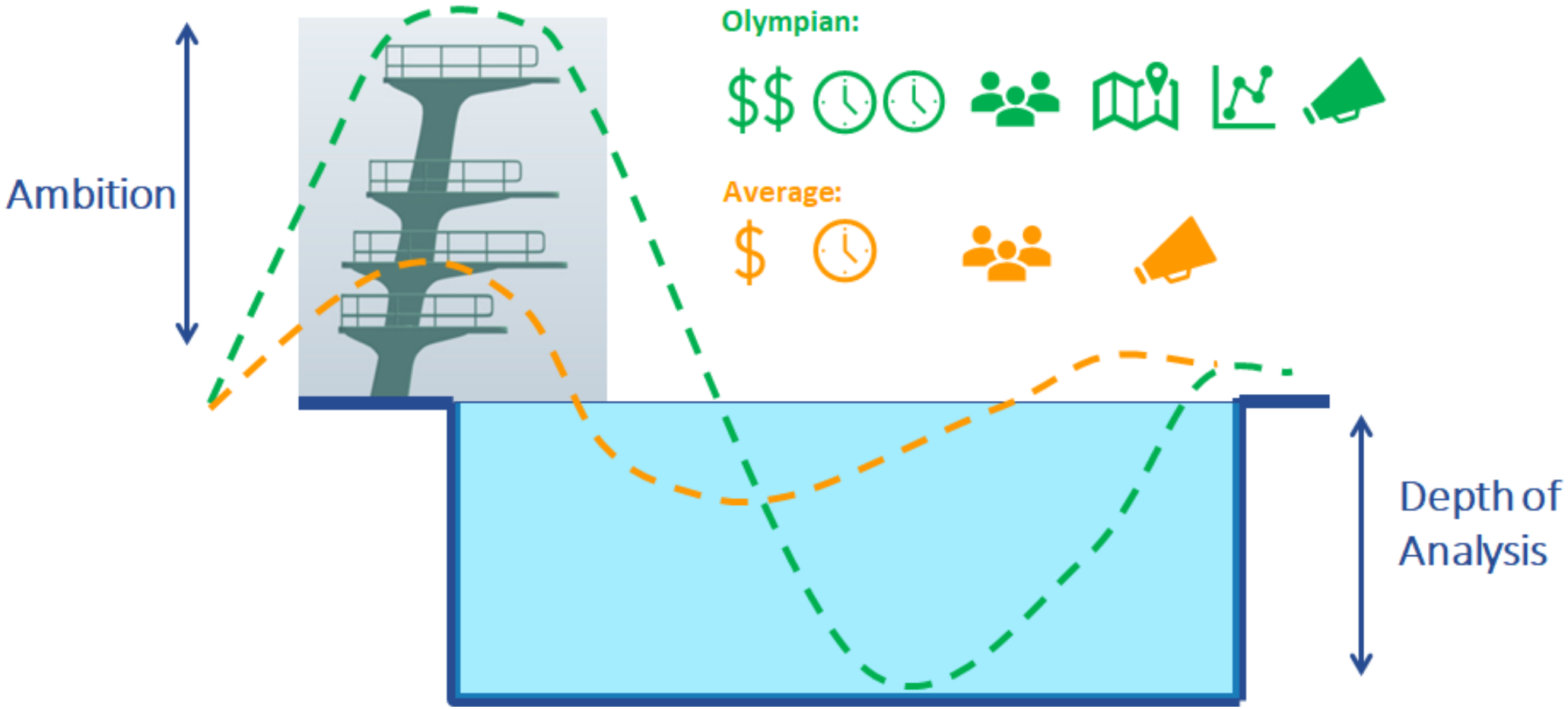
LEVEL OF RIGOUR AND DEPTH OF ANALYSIS – A BALANCING ACT



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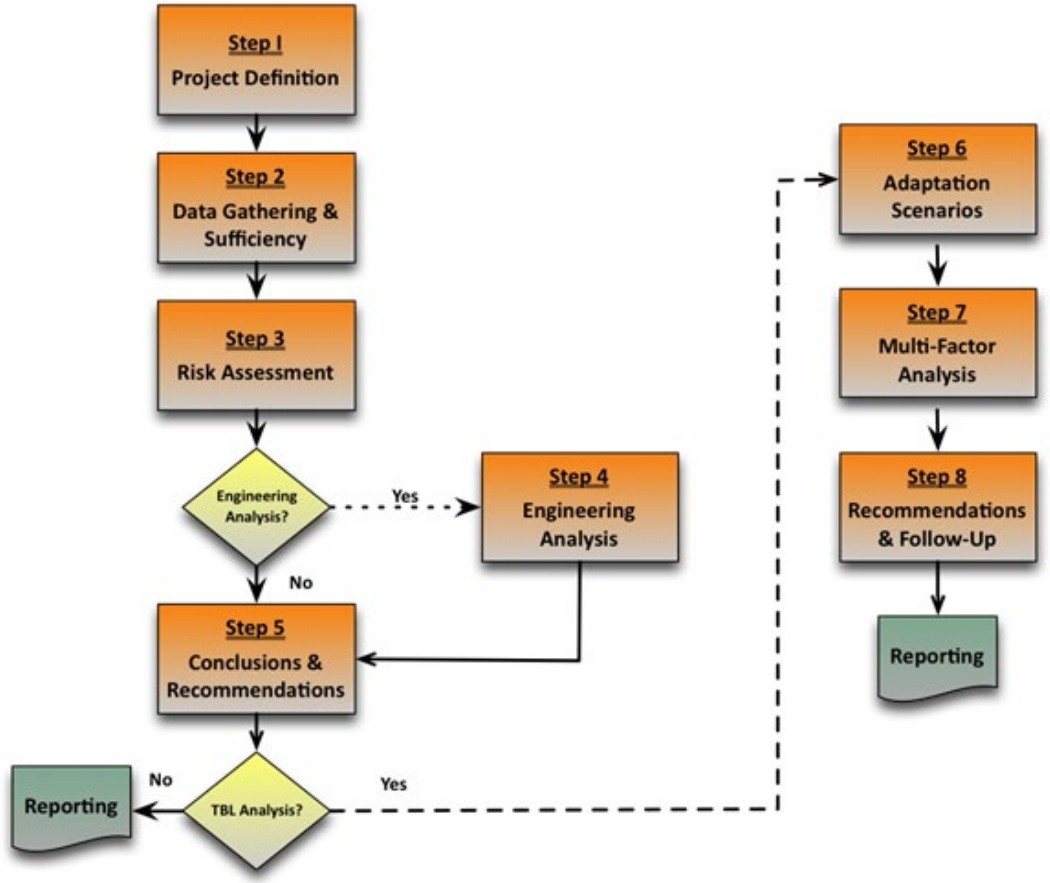
PIEVC PROTOCOL

- **Development began in 2005:** Engineers Canada and support from the Federal Ministry of Natural Resources Canada (NRCan)
- **Nation-wide network and Committee**: Cross section of infrastructure and climate experts, federal, provincial, municipal gov't, utilities, owners, academics, etc.
- **Developed to assist engineers** in factoring climate change impacts into plans for design, operation, maintenance and adaptation of public infrastructure
- **Applied by professional teams** (Engineers, Climate Scientists, Risk Managers, Owners, Operators, Political Decision-Makers, as well as Civil Society stakeholders)



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giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Institute for Catastrophic Loss Reduction
Building resilient communities

WHERE CAN PIEVC BE USED?

- Over 70 completed projects to date:
  - Water resources systems
  - Storm & wastewater systems
  - Roads and bridges
  - Buildings
  - Urban infrastructure systems (utilities)
  - Transportation infrastructure
  - Energy infrastructure
  - Healthcare infrastructure
  - Parks and natural infrastructure (Nature-based Solutions)
- Applied across Canada, and internationally (translated to Spanish, Portuguese, Vietnamese)

Institute for Catastrophic Loss Reduction
Building resilient communities

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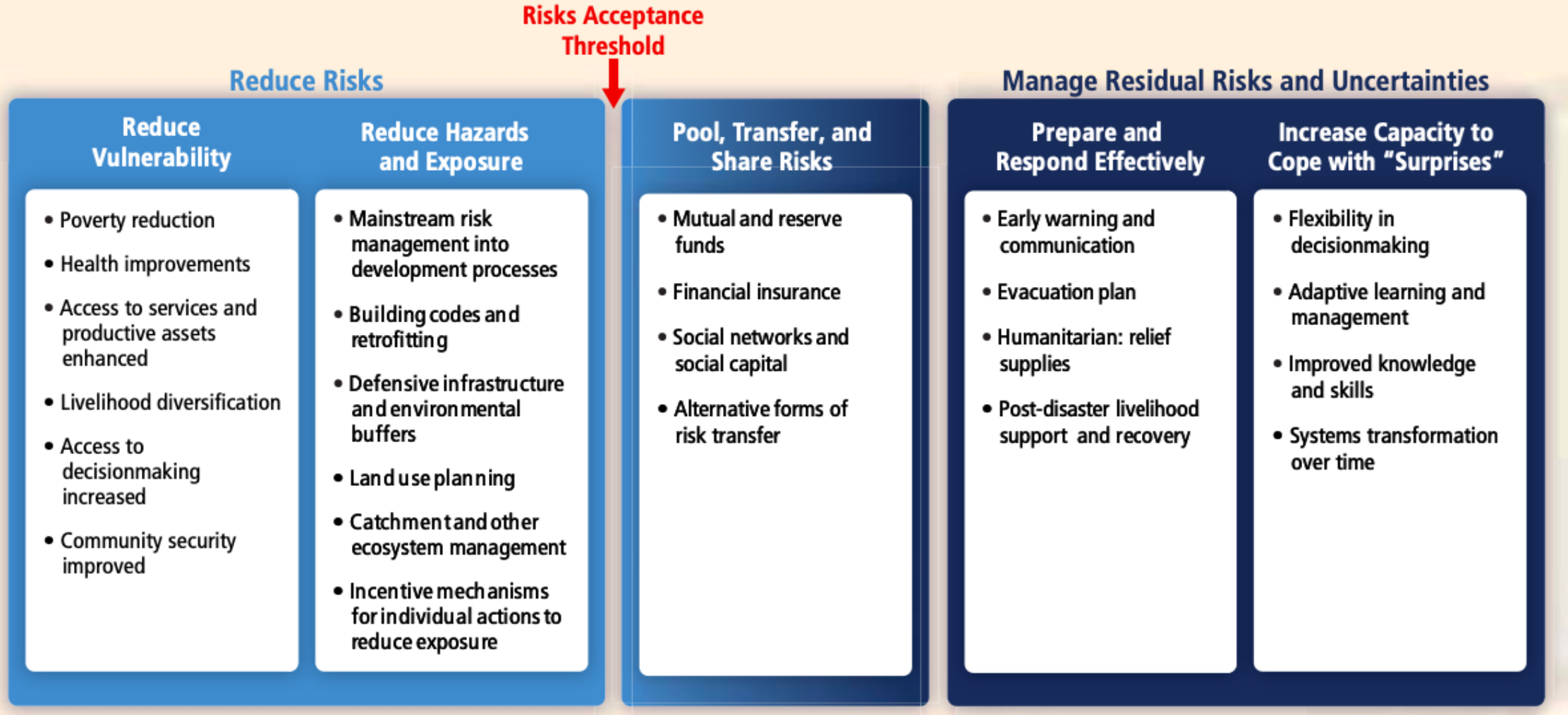
MANAGING CLIMATE RISKS ONCE THEY'RE IDENTIFIED



APPLYING RISK ASSESSMENT OUTPUTS IN MUNICIPAL CONTEXTS

Works	• Identify and improve the resilience of critical infrastructure that are at risk against floods to maintain the intended level of service and prepare for emergencies (e.g. identify and improve the resilience of emergency and evacuation routes, etc.)
Planning / EcDev	• Leverage priority neighbourhoods to emphasize low carbon resilient planning opportunities and interventions based on factors driving up risk
Health	• Share and confirm vulnerable population data used to inform priority neighbourhoods and recommend capacity building and related health measures
Finance	• Collaborate across municipal departments to identify priorities for short term pilot investment, and longer term implementation through capital planning and asset management at a broader scale

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MAINSTREAMING CLIMATE RISK OUTPUTS INTO MUNICIPAL MECHANISMS

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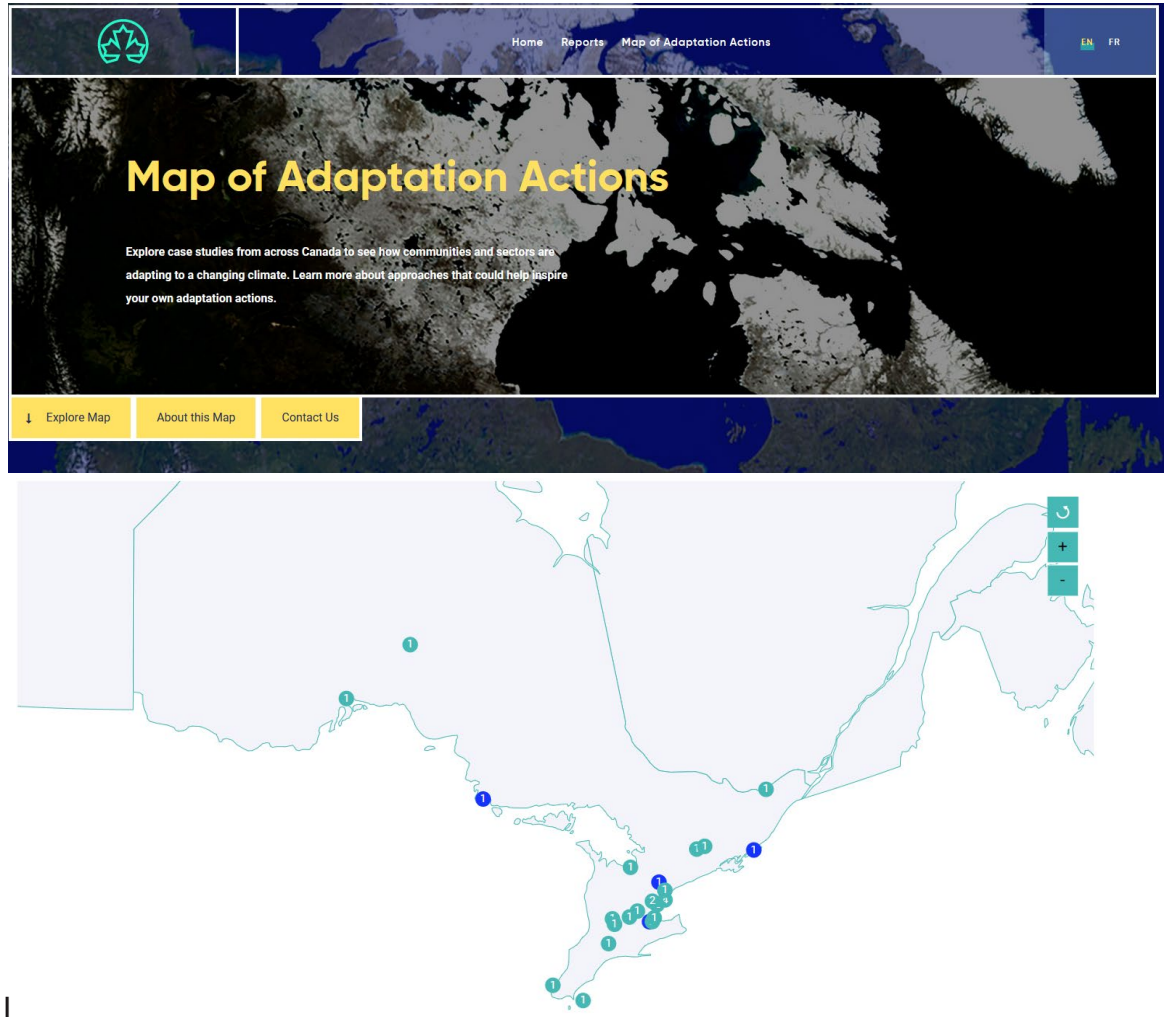
RESOURCES FOR CASE STUDIES



- **Filter by:** climate issue, sector, adaptation stage, type of action and type of setting
- **Ontario Case Studies:**
  - 29 on infrastructure
  - 5 on transportation
  - 46 focused on cities, 7 focused on towns, 18 on rural
- **Examples of interest:**
  - Lake Superior Regulation: Addressing Uncertainty in Upper Great Lakes Water Levels
  - City of Windsor creating a Climate Resilient Home
  - Using the Urban Forest to Mitigate the Urban Heat Island Effect

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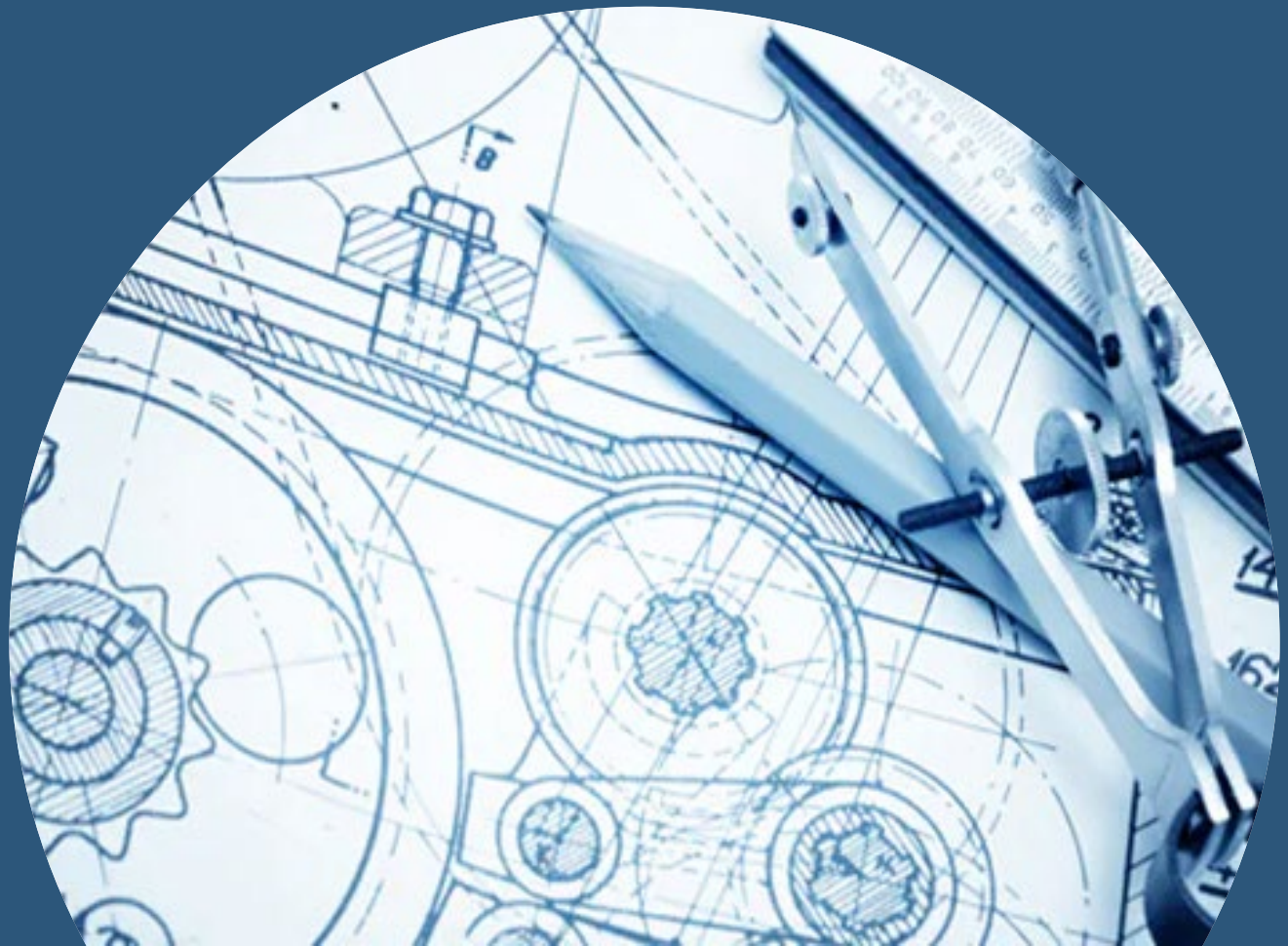
ROLE OF ENGINEERS



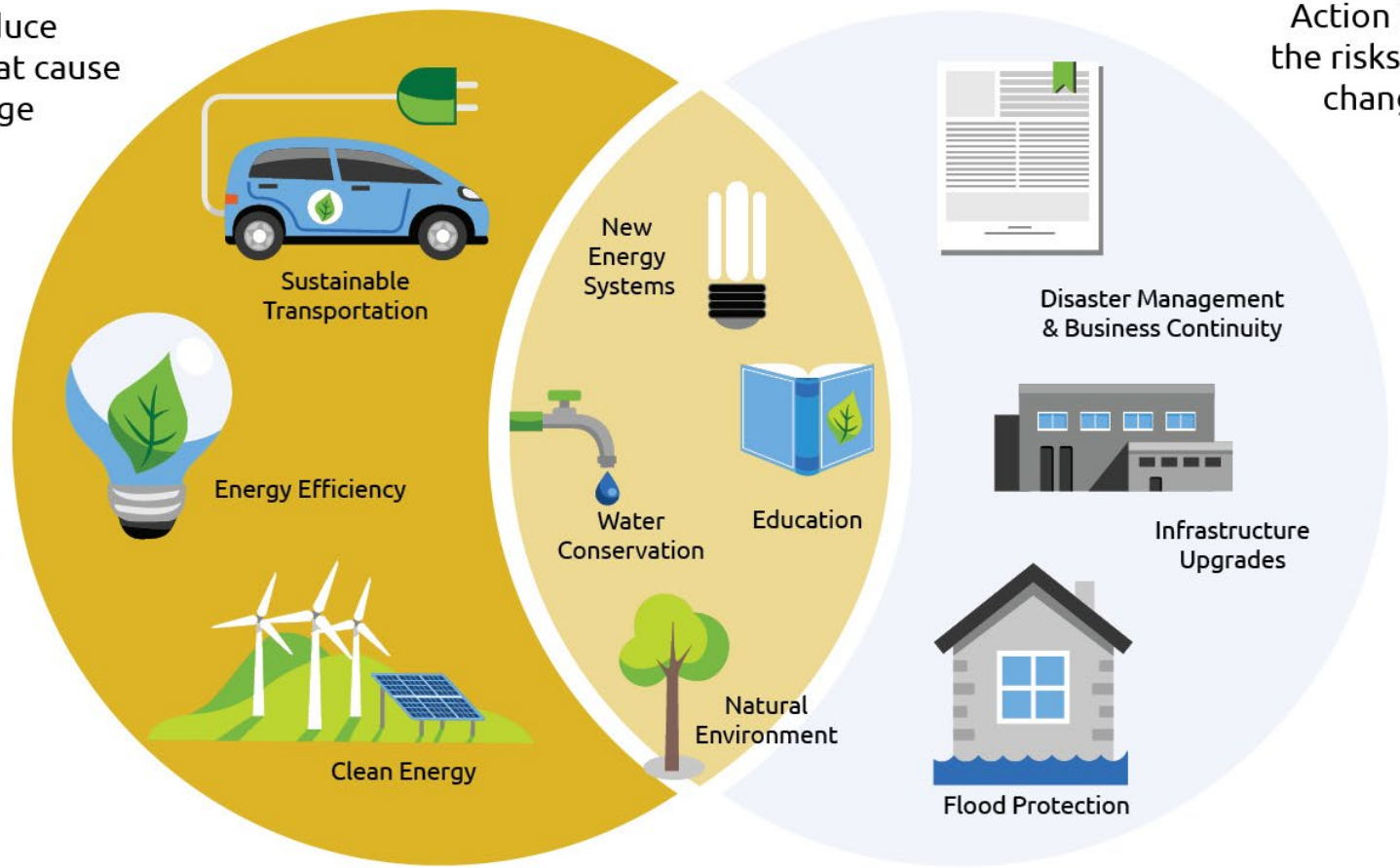
ENGINEERS AND MUNICIPALITIES ARE UNIQUELY POSITIONED FOR MITIGATION AND ADAPTATION

Mitigation

Action to reduce emissions that cause climate change

Adaptation

Action to manage the risks of climate change impacts



MUNICIPAL ENGINEERS ARE ON THE FRONT LINES – AND IN MANY CASES, ARE ADAPTING

- Designing, operating, maintaining and providing expert judgment to provide optimal levels of service
- Protecting people and property, ensuring public safety
- Taking a precautionary approach
- Being proactive and fiscally responsible for robust engineering

What is a Resilient Level of Service?

What **services** does your municipality provide?

What natural and built **assets** are required to deliver those services?

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ROLE OF PROFESSIONAL ENGINEERS

- Enhancing awareness and enable uptake
- Provide technical expertise
- Promote updated information and better data use
- Ensure the protection of public safety and welfare
- Help government and clients

Engineers, under their professional code of ethics, play a fundamental role in ensuring infrastructure designs and operations are continuously adapted to the impacts of climate change to ensure public safety.

- Engineers Canada

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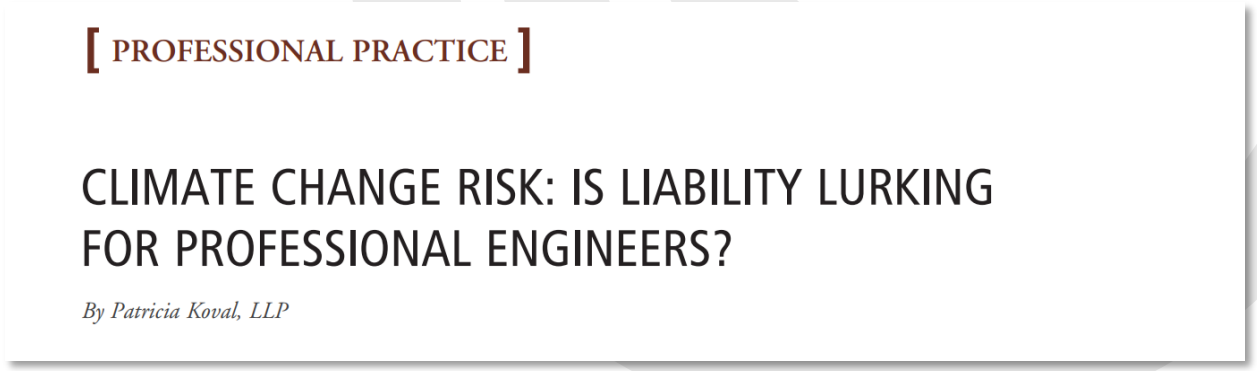
WE CANNOT FORGET ABOUT LIABILITY

1. Professional engineers hold paramount the health, safety and welfare of the public and have regard for the environment
2. Engineers must consider economic, social and environmental factors to achieve sustainable infrastructure that serves the public over its lifespan
3. Extreme weather and changing climate threatens the integrity, durability and reliability of our infrastructure – **now and in the future**



[PROFESSIONAL PRACTICE]

CLIMATE CHANGE RISK: IS LIABILITY LURKING FOR PROFESSIONAL ENGINEERS?

By Patricia Koval, LLP

Engineering Dimensions, 2013

Collaborate via communities of practice to identify best practices.

Learn and share examples and expertise among colleagues.

Document assumptions and uncertainty, and don't hesitate to innovate.

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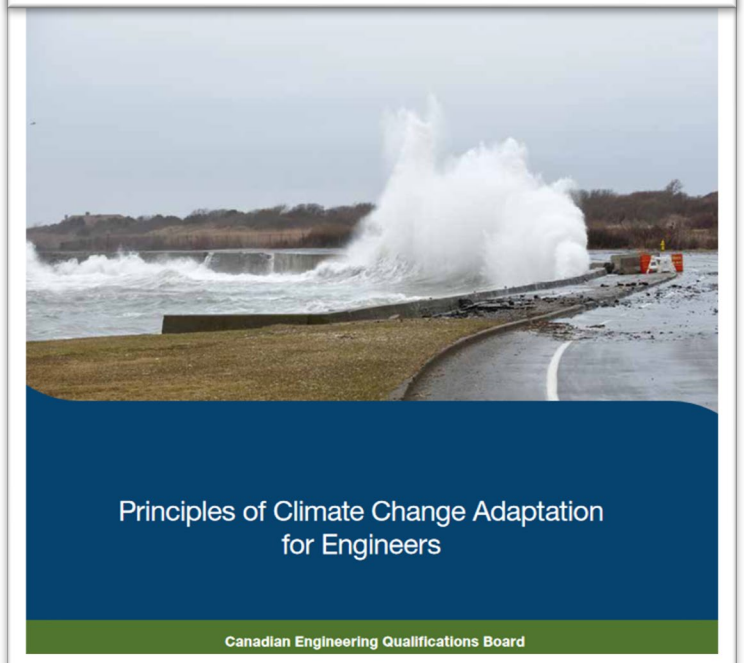
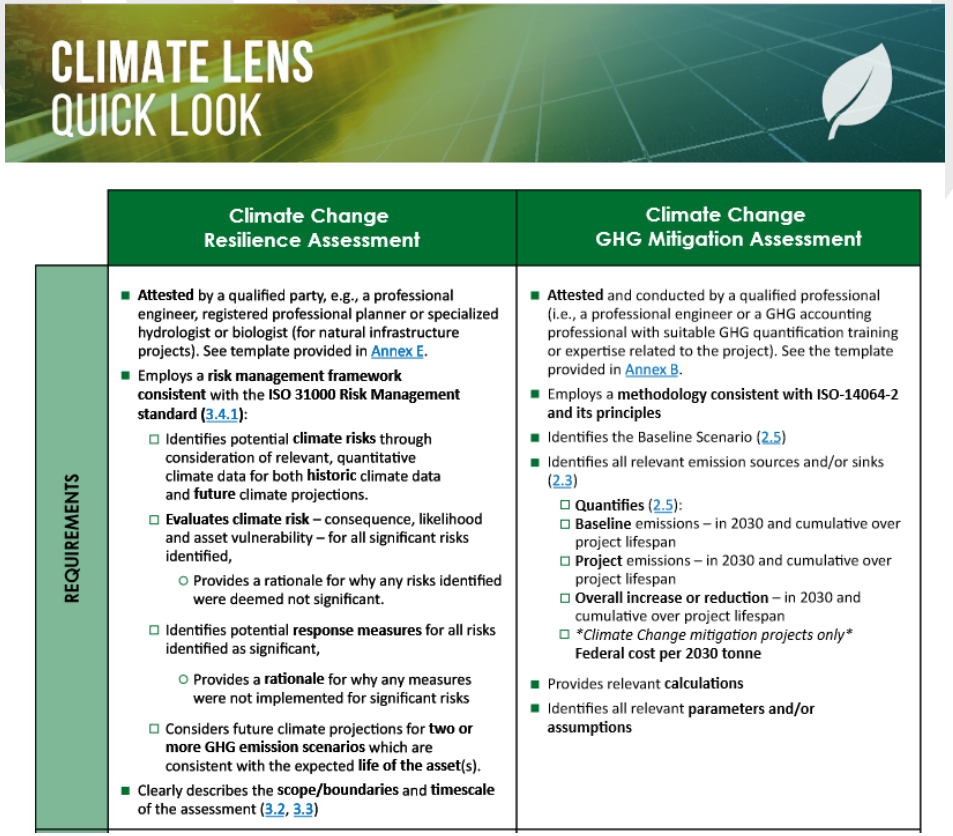
WHERE ARE THINGS HEADING?

- Advancing **rapidly**
- Regulatory bodies changing requirements
- Increasing **advocacy** from Engineers Canada, OSPE
- **Federal funding** for Infrastructure projects tied to GHG mitigation and resilience assessments





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TRAINING

INFRASTRUCTURE RESILIENCE PROFESSIONAL (IRP) COURSES AND CREDENTIAL

- Knowledge and competencies for resilient infrastructure.
- Launched by Engineers Canada in 2016. CRI assumed responsibility in 2020.
- Multiple benefits of being an IRP!

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COURSES AND REQUIREMENTS FOR IRP CREDENTIAL

- Climate Change and Infrastructure Risk Assessment: the PIEVC Protocol
- Asset Management & Climate Resiliency
- Climate Law for Infrastructure Practitioners
- Management of Climate Risk for Infrastructure Professionals
- Applied Climate Science for Infrastructure Practitioners
- Climate Smart Policy and Procurement

IRP Credential

- Individual course quizzes
- Final exam
- Demonstration of Experience

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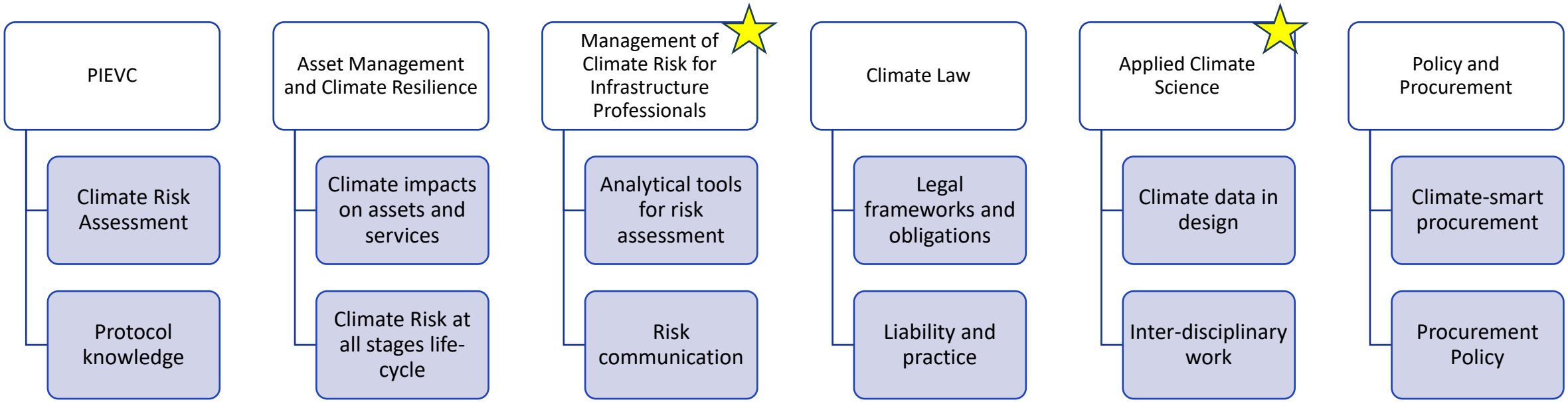
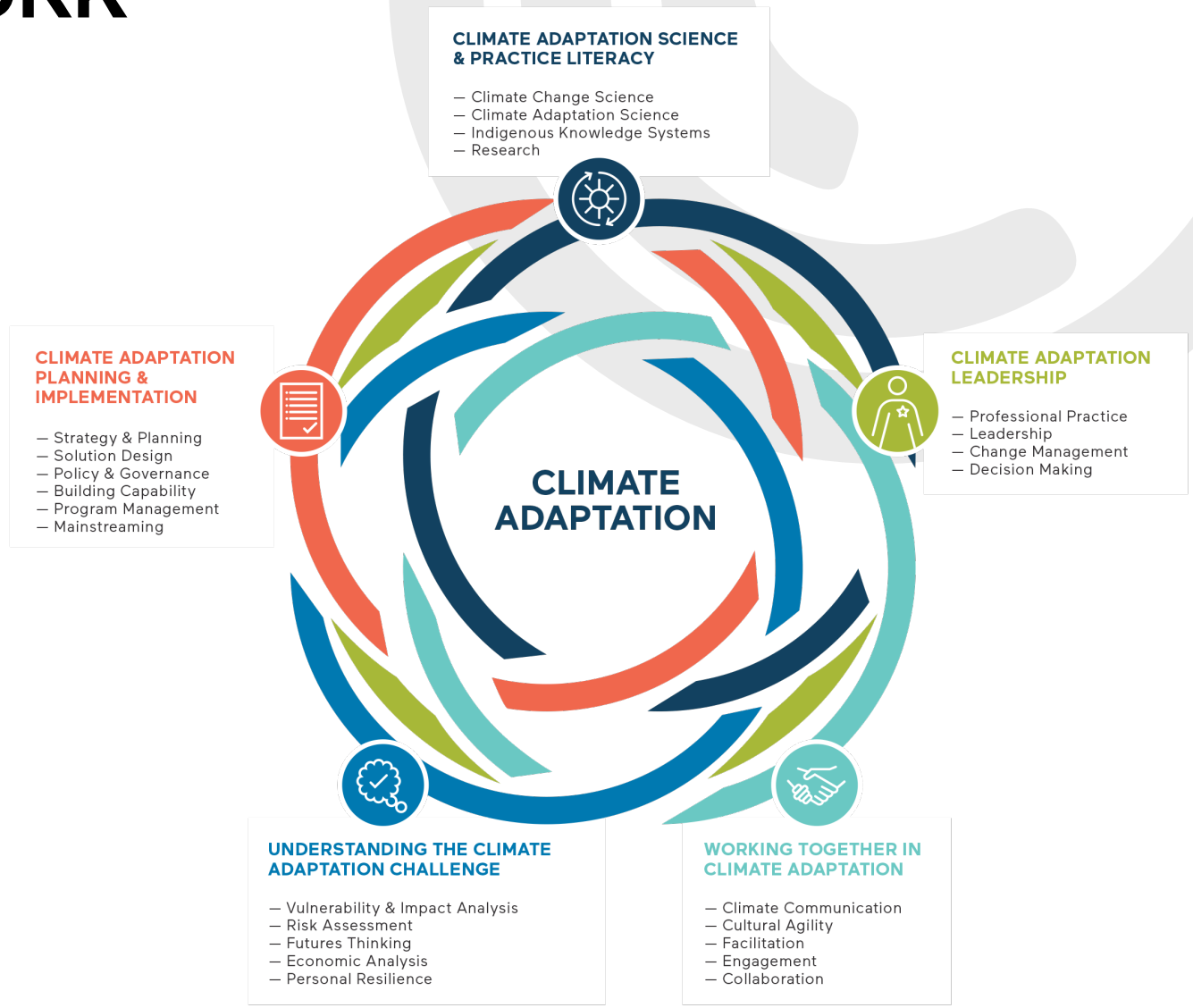
COURSE SNAPSHOTS



Registration open now for May 2022 start dates.

COMPETENCY FRAMEWORK (AND NEW PLATFORMS)

- Courses designed to address identified needs in competency framework.
- CRI moving towards course integration in advanced Learning Management System.
- CRI, Royal Roads University and Resilience by Design working collaboratively on home for adaptation and resilience training in Canada and internationally. → **Can-Adapt**



Royal Roads UNIVERSITY

RESILIENCE BY DESIGN Innovation Lab

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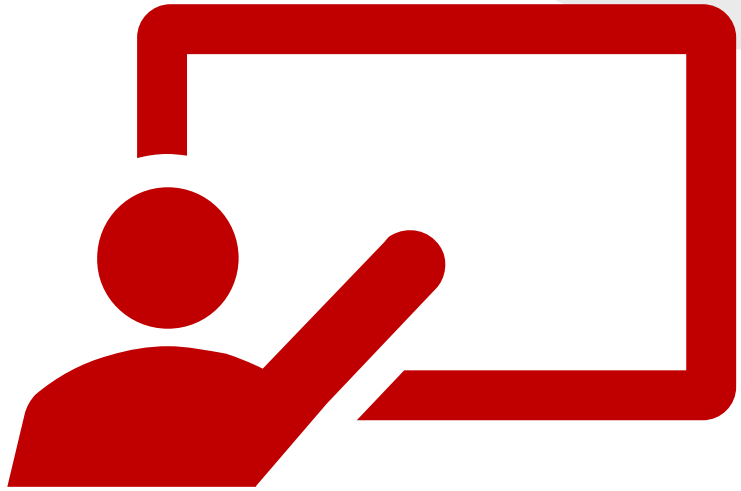
OTHER TRAINING OPPORTUNITIES

- IRP courses open to all (not just engineers)
- Training for Professional Planners
  - Adaptation Planning at Municipal Level
  - Adaptation Policy for Planners
  - Communication of Climate Change for Adaptation
- Customized Training available
  - Targeted training for your group or municipality.



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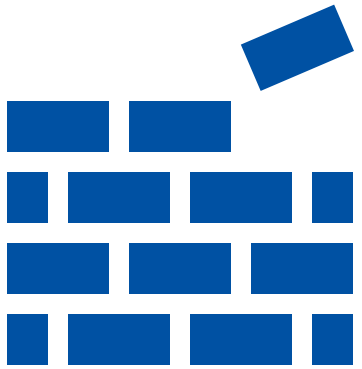
Associates and training faculty

CONCLUDING MESSAGES

1. BEGIN WITH THE END IN MIND

- What specifically will you use the information for?
- What level of detail is needed to enable actions?
- Envision the ideal outputs from your process - do not simply produce a report

2. EQUIP YOURSELF WITH THE RIGHT TOOLS



- Avoid “going down the rabbit hole”
- Select an appropriate framework or process that enables your scale of assessment
- Don’t be afraid to incorporate non-traditional concepts and factors that are important in resilience - social and demographic factors

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3. ENABLE IMPLEMENTATION OF THE RESULTS

- Even at a high level, consider what it will take to implement your results
- Avoid unclear risks, opportunities or resilience building actions
- Identify lead/support roles, timing and costs if possible

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4. BUILD THE CAPACITY YOU NEED

- Know where you (and your municipality) are on assessment scales.
- Identify skills and competencies needed to design, manage for climate risk and to sure you (and infrastructure) are ready and resilient.

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