Infrastructure Canada

Climate Lens
General Guidance

Version 1.3 – September 4, 2020

Canada

Note to Readers:

The guidance in this document is evergreen – meaning it will be periodically updated, as appropriate, based on lessons learned, best practices and evaluation of ongoing and completed assessment activities. Please ensure you consult the Infrastructure Canada website to ensure you have the most recent version of this guidance before undertaking a Climate Lens assessment.

Infrastructure Canada would like to acknowledge the invaluable contribution of expertise and support provided by Environment and Climate Change Canada in the preparation of this guide. Their guidance and support will also help ensure that future iterations of this guide will be useful in assisting infrastructure owners and operators in assessing the greenhouse gas emissions and climate resilience of proposed infrastructure projects.

Version 1.1 Publication Date – June 1, 2018
Version 1.2 Publication Date – October 31, 2019
Version 1.3 Publication Date – September 4, 2020

Contents

1. INTRODUCTION

The purpose of this document is to provide guidance to project proponents or applicants who may need to undertake a Climate Lens assessment. The objectives of this guidance are to:

1. Explain the purpose of the Climate Lens and which projects are subject to the requirement;
2. Provide information on when and how to submit completed assessments to Infrastructure Canada;
3. Describe the requirements for conducting the greenhouse gas (GHG) mitigation assessment component of the Climate Lens; and
4. Describe the requirements for conducting the climate change resilience assessment component of the Climate Lens.

The guidance in this document is evergreen – meaning it will be periodically updated to remain aligned with advancing assessment methodologies. Please ensure you consult the Infrastructure Canada website to ensure you have the most recent version of this guidance before undertaking a Climate Lens assessment.

1.1 What is the Climate Lens?

The Climate Lens is a horizontal requirement applicable to Infrastructure Canada's Investing in Canada Infrastructure Program (ICIP), Disaster Mitigation and Adaptation Fund (DMAF) and Smart Cities Challenge. It has two components: the GHG mitigation assessment, which measures the anticipated GHG emissions impact of an infrastructure project, and the climate change resilience assessment, which employs a risk management approach to anticipate, prevent, withstand, respond to, and recover and adapt from climate change related disruptions or impacts.

Individual proponents will need to undertake one or both types of assessments, depending on the program, funding stream, and the estimated total eligible cost of the project (see 1.3).

1.2 Why implement a Climate Lens?

The Climate Lens will provide meaningful insight into the climate impacts of individual projects, encourage improved choices by project planners consistent with shared federal, provincial, and territorial objectives articulated in the Pan-Canadian Framework for Clean Growth and Climate Change—including a commitment to reduce Canada's GHG emissions by 30% below

2005 levels by 2030—and provides a substantive eligibility test for projects funded through the Climate Change Mitigation and Adaptation, Resilience and Disaster Mitigation sub-streams of the Investing in Canada Infrastructure Program. The Climate Lens is intended to incent behavioral change and consideration of climate impacts into the planning of infrastructure projects with a view to implementing Canada's mid-century goals of a clean growth low-carbon economy. The prescribed assessments will encourage many project proponents to incorporate climate change considerations into their project development process for the first time. By systematically evaluating each project's GHG emissions and/or resilience to the impacts of climate change, project planners will become increasingly familiar with key considerations, risks, and mitigation strategies, which will facilitate better decision making in both current and future infrastructure projects.

Assessments prepared under the Climate Lens will also enable the Government of Canada and proponents to better communicate the anticipated outcomes of federally-supported infrastructure projects to Canadians with respect to climate change efforts.

1.3 Applicable Programs and Submission

The chart below identifies the various programs, streams and sub-streams to which the Climate Lens applies, and lists the project value thresholds at which each assessment will be required.

Table 1: Thresholds for Climate Lens requirements

Programs and Streams	GHG Mitigation Assessment	Climate Change Resilience Assessment	When to submit
Investing in Canada Infrastructure Program (*Integrated Bilateral Agreements*)			
Green Infrastructure – Climate Change Mitigation sub-stream	**All projects*** (Demonstrates alignment with sub-stream outcome)	If total eligible project costs are $10M or greater	GHG Mitigation Assessment due at time of application. Climate Change Resilience Assessment due before first federal payment, if required.
Green Infrastructure – Adaptation, Resilience and Disaster Mitigation sub-stream	If total eligible project costs are $10M or greater	**All projects** (Demonstrates alignment with sub-stream outcome)	Climate Change Resilience Assessment due at time of application. GHG Mitigation Assessment due before first federal payment, if required.
Other streams and Sub-streams (Environmental Quality, Public Transit, Community, Culture and Recreation, Rural and Northern Communities)	If total eligible project costs are $10M or greater	If total eligible project costs are $10M or greater	Both assessments due before first federal payment.
National Programs			

Disaster Mitigation and Adaptation Fund	**All projects**	The Climate Change Resilience Assessment is built into the DMAF application guide	To be submitted as part of the project application For DMAF projects, GHG Mitigation assessments are due before first federal payment
Smart Cities Challenge Winners	If total eligible project costs are $10M or greater and project is a climate change mitigation project	If total eligible project costs are $10M or greater and project is a climate change adaptation, resilience or disaster mitigation project	

**Electricity projects that have already completed a GHG emissions assessment for Natural Resources Canada as part of the Regional Electricity Cooperation and Strategic Infrastructure (RECSI) initiative are not required to complete a second assessment and may submit the existing report to satisfy the Climate Lens GHG Mitigation assessments requirement, provided that the electricity projects submitted for consideration to INFC projects have not been modified to the extent that GHG emissions estimates are significantly altered. In the case that the GHG emissions estimates are significantly altered, updates to the existing report will be required.*

Note that thresholds listed above could be subject to revision as part of a future update to the Climate Lens guidance.

Projects are to be submitted to Infrastructure Canada via the Infrastructure Recipient Information System (IRIS) digital portal (or equivalent), unless otherwise stated in program guidelines.

1.4 Cost Eligibility

The costs of undertaking assessment(s) will be deemed eligible for cost-sharing for all projects approved for federal funding.

Should proponents with projects beneath the threshold wish to undertake a mitigation and/or resilience assessment, these costs would also be deemed eligible for cost-sharing if the project is approved for federal funding, as long as the assessment conforms to the requirements of the Climate Lens specified herein and is submitted to Infrastructure Canada at the time of application.

Because costs are only eligible for reimbursement for federally approved projects, municipalities, Indigenous communities, and other potential applicants are encouraged to engage regularly with the relevant province or territory to determine their project's likelihood of prioritization before undertaking a Climate Lens assessment.

In light of the capacity limitations faced by some applicants, (e.g., small communities with a population of 5,000 or less) threshold exemptions could be granted by the Minister of Infrastructure and Communities on a case-by-case basis. Exemptions may also be considered if the infrastructure asset is unlikely to involve opportunities to reduce GHG emissions nor likely to be at risk from climate change impacts. Assessments will remain mandatory for all project proponents applying to the two climate-focused sub-streams.

In the case of the Smart Cities Challenge, winners will be required to apply the Climate Lens if one of the primary outcomes of their project is a GHG mitigation or a climate change resilience project. For the Disaster Mitigation and Adaptation Fund, only projects submitting full applications will be required to apply the GHG Mitigation Assessment. The Climate Change Resilience Assessment is built into the DMAF Full Application guide. There is no assessment requirement at the Expression of Interest stage.

The guidance in this document is evergreen - meaning it will be periodically updated, as appropriate, based on lessons learned, best practices and evaluation of ongoing and completed assessment activities. Please ensure you consult the Infrastructure Canada website to ensure you have the most recent version of this guidance before undertaking a Climate Lens assessment.

1.5 Potential Equivalency of Provincial and Territorial Assessment Approaches

Where provinces and territories have developed an equivalent approach to assessing GHG emissions and mitigation opportunities, and/or asset resilience to the impacts of climate change, Infrastructure Canada may choose to deem these approaches as equivalent as the Climate Lens. However, in all cases, applicants will be required to supply the information prescribed in the pages that follow, and to share the assessment reports with Infrastructure Canada in their entirety.

2. GREENHOUSE GAS MITIGATION ASSESSMENT

Section 2 describes the general parameters and methodological approach to project level-greenhouse gas (GHG) mitigation assessment. The general guidance provided here is designed to complement ISO 14064 Part Two: Specification with Guidance at the Project Level for Quantification, Monitoring, and Reporting of Greenhouse Gas Emission Reductions or Removal Enhancements, which is the required standard for GHG mitigation assessments under the Climate Lens. Should applicants require further direction or clarity on specific procedures and calculation methods, the GHG Protocol for Project Accounting is recommended as a supplementary resource. More detailed sector-specific technical guidance, including sample templates, will be prepared and shared with applicants in the coming months. The forthcoming sector-specific technical guidance is intended to clarify methods and reduce the level of effort required to complete GHG mitigation assessments. The sector-specific guidance will also aim to increase the consistency of results across individual assessments.

To be accepted by Infrastructure Canada, the assessment must be **conducted by a qualified professional**, as described in section 2.1. Sections 2.2, 2.3 and 2.4 set out the **assessment parameters**, including relevant GHGs, the assessment boundary, and the timescale for the assessment. Section 2.5 lays out the required **information** and relevant **general instructions**.

2.1 Development by a Qualified Party

Acceptable mitigation assessments must be conducted by a qualified professional (i.e., a professional engineer or a GHG accounting professional with suitable GHG quantification training or expertise related to the project). In all instances, the qualified professional will need to provide an attestation confirming that the assessment conforms to the general and sector-specific technical guidance provided by Infrastructure Canada. This attestation must be submitted alongside the assessment report. As noted in section 1, for approved projects, costs associated with Climate Lens assessments will be retroactively eligible for reimbursement.

2.2 Relevant Greenhouse Gases

Mitigation assessments will consider the same greenhouse gases tracked through Canada's National Inventory Report. Specific gases could be excluded if deemed insignificant and appropriately rationalized through the assessment report. Further guidance on the significance of individual GHGs will be provided through forthcoming sector-specific technical guidance, as appropriate.

Emissions must be converted into CO_2 equivalent (CO_2e) using the Global Warming Potentials identified in the most up-to-date version of Canada's National Inventory Report (see **Annex C**) and reported in tonnes (t), kilotonnes (kt), or megatonnes (Mt).

2.3 Assessment Boundary

The Assessment Boundary defines the scope of the mitigation assessment. Mitigation assessments are to consider all direct and all *significant* indirect emissions and emissions reductions linked to the project.

- **Direct Emissions:** Emissions or removals from GHG sources or sinks that are owned or controlled by the proponent. At the GHG inventory level, direct emissions are also commonly referenced as *Scope 1* emissions.

- **Indirect Emissions:** Emissions or removals that are of consequence to the project, but occur at GHG sources or sinks not owned or controlled by the proponent. For example, reduced electricity consumption might be considered a secondary effect in some infrastructure projects. Indirect emissions can include *Scope 2* emissions as well as some *Scope 3* emissions as defined under the GHG Protocol.

Note that for reporting purposes, any emissions reductions achieved outside of Canada must be segregated and reported separately, as they will not contribute to the program's national GHG reduction target. Further, international emissions reductions and purchased offsets or carbon credits will not be considered when determining the eligibility of projects submitted under the Climate Change Mitigation sub-stream (these projects are meant to set Canada on a path to a low-carbon future, and must therefore demonstrate an overall reduction in emissions within Canada).

Table 2: Sample Crosswalk of Project-Level Effects to Inventory Emissions

DIRECT EFFECTS	INDIRECT EFFECTS	
Scope 1	***Scope 2***	***Scope 3***
• Water or wastewater treatment processes • Generation of electricity • Operation of rolling stock • Ice plant operations in a	• Purchased electricity • Purchased natural gas • Purchased steam • Purchased heating / cooling (e.g., from an adjacent	*Upstream Effects* • Expected shifts in fuel sources for electricity • Inbound transport of solid waste *Downstream Effects*

hockey or curling rink • On-site remediation and/or construction activities • Solid waste disposal • Production of biogas	building)	• Downstream electricity consumption • Impacts on traffic / personal vehicle travel • Biosolids transport and distribution effects (e.g. reduced local use of nitrogen fertilizer) • Impacts on land use / population density

Further information and examples of significant secondary or indirect effects, and how to identify them in the assessment report will be made available through forthcoming sector-specific technical guidance.

Applicants who wish to employ a broader assessment boundary than that prescribed by Infrastructure Canada are welcome to do so, but should discuss the associated potential for additional assessment costs with their professional service provider (if applicable). Depending on the type of infrastructure being assessed, Applicants may judge it useful to expand the scope of the assessment to include additional indirect emissions in order to fully capture a project's reductions potential. For example, the introduction of a new public transit line could produce GHG reductions through modal shift and/or long-term changes in population density and land use patterns.

2.4 Timescale / Forecast Window

Mitigation assessments will assess each project across the construction (excluding supply chain) and operations and maintenance (O&M) phases. The assessment should not seek to estimate construction emissions associated with the asset's future major rehabilitative maintenance or decommissioning.

Assessments should include estimates of a project's cumulative construction and O&M emissions over the useful lifespan of the infrastructure, i.e., annual emissions for each year from the start year of the project to the end of its useful life.

Specific reporting in the assessment's Executive Summary will be required in connection to the year 2030 to align with Canada's GHG reduction commitment under the Paris Agreement.

As noted above, quantification of supply chain emissions is not required given the complexities associated with both sourcing and quantifying these emissions. However, applicants wishing to highlight the benefit of green procurement strategies and/or those interested in pursuing a more robust analysis are welcome to assess these elements. Where applicable, interested applicants should discuss the potential for additional costs with their professional service provider.

2.5 Required Information and General Instructions

The following information constitutes the mandatory reporting requirements associated with mitigation assessments. Project-level emissions must be calculated under a baseline scenario as well as the project scenario, and the difference between these two scenarios will establish the net increase or reduction in emissions. The high-level results identified below should be explicitly referenced in an Executive Summary of the mitigation assessment when it is submitted to Infrastructure Canada. This will facilitate the online application process via the Infrastructure Recipient Information System (IRIS) digital portal, where this information will be required. The underlying assumptions and data used to calculate emissions and prepare estimates must be documented in the body of the assessment report.

A sample table of contents for GHG mitigation assessments can be found at **Annex A**.

i. Baseline GHG emissions calculations

Assessments should establish a baseline or business-as-usual (BAU) emissions trajectory which will form the baseline scenario representative of the most probable emissions in the absence of the proposed project (this is sometimes also known as a 'counterfactual' scenario). This baseline depicts the emissions trajectory in the absence of the proposed project. This baseline and the asset's estimated emissions should be tailored to consider the relevant provincial or territorial energy mix (e.g., electricity generation sources). This information is available through Natural Resources Canada and/or the National Energy Board and will also be highlighted in the forthcoming sector-specific technical guidance. The BAU baseline must be calculated cumulatively (year-by-year) for the asset's full useful life, as well as in the year 2030. The net increase or decrease in emissions linked to the proposed project will be calculated against this baseline.

The assessment's Executive Summary should expressly identify the BAU baseline emissions in 2030 as well as cumulative BAU emissions over the asset's lifespan.

Further guidance on the development of an emissions baseline is available in ISO 14064-2 and/or the GHG Protocol for Project Accounting.

Key considerations linked to the development of a BAU baseline could include:

- How to define the geographic area impacted by the project and its emissions/reductions;
- Expectations regarding the infrastructure's immediate and future service outputs;
- Whether the BAU enables the assessment to capture emission reductions linked to new process and/or system efficiencies implemented under the project scenario;
- Whether the selected BAU scenario represents the most conservative viable alternative to the project; and
- Whether there are barriers to a 'do-nothing' alternative, such as the introduction of new mandatory performance or regulatory standards, which would inform the

baseline. This is particularly relevant to retrofit projects.

Applicants (and any qualified professionals attesting to the conformity of the GHG assessment with the Guidance) will often be required to exercise professional judgement in addressing these principles.

Baseline and project calculations should employ emissions factors identified by the relevant provincial or territorial government (when available), or in Canada's most recent National Inventory Report. Specific emission factors relevant to individual sectors/asset types will be identified through the forthcoming sector-specific technical guidance. Should additional emissions factors be required, these could be sourced from the emissions factor database maintained by the Intergovernmental Panel on Climate Change (IPCC) and thoroughly vetted to ensure they are appropriate to the specific asset / infrastructure category and the Canadian context. The selection of any additional or alternative emissions factors must be rationalized in the assessment to demonstrate their impartiality and appropriateness.

In addition to baseline scenario emissions, these calculations would consider any relevant **GHG removals**, i.e., the calculated mass of GHGs removed from the atmosphere over a defined period of time through storage or a carbon sink. An example of a carbon sink might be a wetland or forest.

Table 3: Sample Calculations Table for Baseline Scenario Emissions and Removals

Year	Total net baseline scenario emissions (A)	Total net baseline scenario removals (B)	Total net baseline emissions and removals (A-B)
Year 1			
Year 2			
Year 3			
Year 4			
Year …			
Lifespan Totals			

ii. Asset's estimated GHG emissions calculations

Assessments are required to calculate the asset's estimated carbon emissions based on the assessment boundary and timescale outlined above.

Total emissions over the asset's expected lifespan, as well as total emissions in the year 2030, must be highlighted in the assessment's Executive Summary.

The body of the report must detail emissions calculations for each calendar year, and provide the cumulative total. The assessment should also explicitly identify the GHG impact of the construction phase relative to overall lifespan emissions (however, as noted previously quantification of supply chain emissions is not required).

The quantification process should adhere to the following principles. These are also identified in both the ISO 14064-2 standard and the GHG Protocol for Project Accounting:

- **Relevance:** The data and GHG quantification procedures most appropriate to the project should be selected. The levels of accuracy and uncertainty associated with the quantification process should reflect the intended use of the data and the objectives of the project.

- **Completeness:** All relevant GHG emissions and removals should be included, along with information to support criteria and procedures.

- **Consistency:** All data, methods, criteria, and assumptions shall be applied consistently to ensure meaningful comparisons between the baseline and project scenario.

- **Accuracy:** Estimates and calculations should be unbiased, and uncertainties should be reduced as far as practical. Calculations should be conducted in a manner that minimizes uncertainty.

- **Transparency:** All assumptions, methods, calculations, and associated uncertainties should be explained to allow for the intended users to make decisions with reasonable confidence.

- **Conservativeness**: Where there are uncertainties, the values used to quantify GHG emissions should err on the side of underestimating potential reductions.

Applicants (and any qualified professionals attesting to the conformity of the GHG assessment with the Guidance) will often be required to exercise professional judgement in applying these principles.

Asset emissions calculations should employ emissions factors identified by the relevant provincial or territorial government (when available), or in Canada's most recent National Inventory Report. Specific emission factors relevant to individual sectors/asset types will be identified through the forthcoming sector-specific technical guidance.

Should additional emissions factors be required, these could be sourced from the emissions factor database maintained by the Intergovernmental Panel on Climate Change (IPCC) and thoroughly vetted to ensure they are appropriate to the specific asset / infrastructure category and the Canadian context. The selection of any additional or alternative

emissions factors must be rationalized in the assessment to demonstrate their impartiality and appropriateness.

A NOTE ON CAPTURING EFFICIENCIES:

While it is not required, applicants may benefit from calculating their asset's GHG emissions per unit of service in the year 2030, which would provide a more complete view of the project's climate benefits. For instance, many new assets might provide additional units of service and/or perform their functions more efficiently than under the BAU scenario. Such a calculation would therefore measure project emissions relative to the service or public benefit produced (e.g., annual GHG emissions per cubic meter of wastewater treated). This type of metric may be especially helpful in contextualizing emissions in infrastructure projects where an overall reduction in emissions is not expected relative to the BAU scenario.

Table 4: Sample Calculations Table for Project Scenario Emissions and Removals

Year	Total project scenario emissions (A)	Total project scenario removals (B)	Total net project emissions and removals (A-B)
Year 1			
Year 2			
Year 3			
Year 4			
Year …			
Lifespan Totals			

** In-Canada effects and international effects must be reported separately*

iii. Net increase/reduction in GHG emissions

The Executive Summary must highlight the net increase or net reduction in GHG emissions relative to the business-as-usual emissions baseline in the year 2030 and cumulatively over the full anticipated lifespan of the asset. A sample table that can be used to submit this information has been provided in Table 5, below.

Table 5: Net increase/reduction in GHG emissions in 2030 and cumulative over asset lifespan

GHG Mitigation Assessment					
2030 GHG Results			**Lifetime GHG Results**		
Baseline scenario emissions, in 2030		CO_2e value in Tonnes	Baseline scenario emissions, Lifetime (cumulative)		CO_2e value in Tonnes
Estimated project emissions, in 2030		CO_2e value in Tonnes	Estimated project emissions, Lifetime (cumulative)		CO_2e value in Tonnes
Net emissions	REDUCTION or INCREASE	CO_2e value in Tonnes	Net emissions	REDUCTION or INCREASE	CO_2e value in Tonnes

In select projects, and all projects under the Climate Change Mitigation sub-stream, this calculation will identify **GHG reductions,** which are defined under the GHG Protocol as a decrease in GHG emissions or an increase in removal or storage of GHGs from the atmosphere, relative to baseline emissions.

Table 6: Sample Calculations Table for Net Change in Emissions and Reductions/Removals

Year	**Total net project scenario emissions and removals (A)**	**Total net baseline scenario emissions and removals (B)**	**Total net change in emissions and removals (A-B)**
Year 1			
Year 2			
Year 3			
Year 4			
Year …			
Lifespan Totals			

** In-Canada effects and international effects must be reported separately*

iv. Cost-per-tonne calculations

A cost-per-tonne calculation will be prepared for each project under the Climate Change Mitigation sub-stream. In the near term, the objective of the metric would be to prepare an estimate of the quantity of emissions reduced as a result of program spending, both in the year 2030 and over each asset's expected lifespan.

The cost-per-tonne metric will allow provincial and territorial governments, and Infrastructure Canada, to gauge the cost-effectiveness of each jurisdiction's Climate Change Mitigation spending and promote the prioritization of high-impact mitigation projects, including those aligned with the provincial and territorial Key Actions identified under the Pan-Canadian Framework on Clean Growth and Climate Change.

Applicants will need to:

1. Calculate net GHG reduction estimates (the difference between the baseline scenario and project scenario) both in 2030 and over the full expected life of the asset.

2. Provide an estimation of the total construction costs and O&M costs over lifetime of project:

    - Specify total eligible project costs

    - Specify the requested federal contribution

3. Calculate two cost-per-tonne indicators:

    - Federal dollars/GHG reductions in 2030 (non-cumulative)

    - Total project cost (construction cost and O&M costs over lifetime) / cumulative GHG reductions over the asset's expected lifespan

The Executive Summary must highlight the <u>total project</u> cost-per-tonne.

More detailed instructions will be provided in the forthcoming sector specific guidance. As the Climate Lens guidance is evergreen, the cost-per-tonne metric will be adjusted over time as methodology improves and capacity to conduct assessments grows across Canada. Over the long term, a more fulsome cost-per-tonne approach could be introduced.

v. Optional identification of GHG mitigation opportunities

A key objective of the Climate Lens is the facilitation of climate-focused behavioural change at the project level. In the interest of driving new and better project planning behaviours, applicants wishing to perform a more robust assessment are invited to identify all reasonable opportunities to avoid or mitigate GHG emissions within the context of their specific projects.

While Infrastructure Canada recognizes that in certain cases it may be too late to implement major scope changes, less significant adjustments may still be feasible, and large-scale alterations could inform the planning of similar future assets.

Applicants may also wish to estimate the cost differential between the chosen and alternative options on a percentage basis to inform their own current and future decision-making.

2.6 Additional Supports for Applicants

Infrastructure Canada is working with Environment and Climate Change Canada as well as other partners to develop measures (e.g., sector-specific technical guidance, which will include a "Climate Lite" GHG assessment option for projects outside the Climate Change Mitigation sub-stream), tools and/or other training materials that will reduce the level of effort required and increase the degree of standardization associated with individual mitigation assessments. More details about these resources will be shared as they become available. Please visit the Infrastructure Canada website to ensure you have the most up-to-date list of available resources.

3. CLIMATE CHANGE RESILIENCE ASSESSMENT

This section provides guidance on conducting the climate change resilience assessment component of the Climate Lens. Section 3.1 – 3.3 describes the **scope and general approach** of the resilience assessment. Section 3.4 explains the risk management framework and guiding **methodology** for undertaking the resilience assessment. Section 3.5 provides guidance to help **determine the appropriate level of risk analysis** of an assessment. Finally, section 3.6 identifies key **reporting** requirements stemming from the resilience assessment. Annexes D to I provide further information to help proponents conduct a climate change resilience assessment.

3.1 Development by a Qualified Party

Infrastructure Canada will require that a qualified party, e.g., a professional engineer, registered professional planner, or appropriately specialized biologist or hydrologist provide an attestation that the climate change resilience assessment was carried out according to Infrastructure Canada's Climate Lens guidance. These professionals need to demonstrate expertise in conducting infrastructure resilience assessments which ideally includes holding appropriate credentials (i.e., Canadian Risk Management designation, ISO 31000 training or equivalent) and/or relevant work experience (e.g., noting recent project examples).

This attestation must be provided alongside the assessment report. As noted in Section 1, for approved projects, costs associated with Climate Lens assessments will be retroactively eligible for reimbursement.

3.2 Scope and Boundaries of the Assessment

The climate change resilience assessment is designed to support better decision-making during an infrastructure project's planning and design stages. The scope and boundaries of the assessment must be clearly described (e.g., what is included and excluded from the analysis and why). It should consider the full spectrum of project design choices being made (e.g., location, materials used, construction methods/standards, etc.). It should also consider climate risks during the construction phase as well as changes in climate risks during the planned operation and maintenance phases. Consideration of decommissioning is out of the scope of the assessment. The assessment should not only include asset-specific resilience solutions, but also identify the potential immediate upstream and downstream impacts of proposed resilience solutions within the broader system (e.g., reduction of downstream flooding resulting from raising the bed of a river to allow temporary water storage in a wetland).

3.3 Timescale of the Assessment

The timescale of the assessment must match the intended lifespan of the asset, unless there is an appropriate justification for using a different timeframe. For longer-lifespan assets, both shorter-term and longer-term climate change impacts must also be examined, as well as different emissions scenarios. More information on emissions scenarios is available in Section 3.4. For example, in the construction of the Confederation Bridge linking Prince Edward Island and New Brunswick, engineers and planners used various climate scenarios to determine an appropriate height to account for future rise in sea level, and appropriate spacing between support beams to allow ice blocks to pass safely underneath.

3.4 Risk Management Framework

The climate change resilience assessment is a risk assessment that includes the analysis of future climate conditions and risk treatment for the proposed project. The objective of this exercise is to identify, evaluate and manage risks. Risk management could involve doing nothing or implementing risk treatment strategies, thereby reducing the risk to an acceptable level by enhancing the resilience or adaptability of assets or systems to climate change impacts.

Future climate projections are available for many parts of the country and should enable identification of general trends associated with a changing climate in a given area. There may be numerous adaptive and resilient solutions to choose from, based on time, complexity and cost. The risk management process helps identify best solutions. It is a practical approach to identifying and prioritizing complex risk issues, and for selecting optimal solutions in the face of uncertainty.

3.4.1 Guiding Methodology

Projects undertaking a climate change resilience assessment must be broadly consistent with the key steps of the ISO 31000 Risk Management Standard and include both current and future climate conditions and impacts in the analysis. A globally recognized approach, this standard provides a generic risk management model that walks users through the steps of gathering information, assessing risk and developing a risk treatment plan. This standard was designed to accommodate any kind of risk to an organization but can be tailored to assess climate risks posed to individual infrastructure assets. Annex G includes a list of methodologies that are consistent with the ISO 31000 standard and steps to conduct a climate change resilience assessment.

The first step in assessing the potential impacts of climate change is to understand the interactions of historical climate conditions with your geographical area of interest, (i.e., where your asset will be located), both in terms of trends in key climate variables (e.g., precipitation or temperature) and records of extreme events (e.g., heat waves, floods). Understanding this historical record can help identify areas of vulnerability and provide a baseline of climate conditions to compare against projected future changes in the climate.

ECCC provides climate model projections for a range of emission scenarios, also called Representative Concentration Pathways (RCPs). These are a set of emission scenarios that range from a low emission scenario characterized by active GHG mitigation (RCP 2.6), through intermediate scenarios (RCP 4.5), to a high emission scenario (RCP 8.5).

Per best practice in climate science, multiple climate models (i.e, multi-model ensembles that group results from multiple climate models together) that project future changes across a range of greenhouse gas emission scenarios should be used when assessing the potential impacts of climate change.

More information about how to access and use historical and future climate data can be obtained from the Canadian Centre for Climate Services (CCCS), established by the Government of Canada so that Canadians have the information and support they need to understand and reduce the risks from climate change.

Annex H provides a list of resources that are helpful for resilience assessments, including links to the CCCS, regional climate service providers, tools to guide climate risk analysis, and broader assessment of impacts and adaptation across Canada.

Infrastructure Canada has developed a set of guiding principles to go along with ISO 31000, which are derived from international agreements such as the Sendai Framework for Disaster Risk Reduction, the UN's Sustainable Development Goals and Canada's National Strategy for Critical Infrastructure which emphasize resilience as a way to mitigate disasters and natural hazards. They are also informed by Canada's Federal Adaptation Policy Framework and national climate knowledge assessments produced by Natural Resources Canada. They are:

- Proportionate Assessment
- Systemic Analysis of Risk
- Pursuit of Multiple Benefits
- Avoiding Unintended Results

More detailed definitions of these principles are included in Annex F. ECCC provides climate model projections for a range of emission scenarios, also called Representative Concentration Pathways (RCPs). These are a set of emission scenarios that range from a low emission scenario characterized by active GHG mitigation (RCP 2.6), through intermediate scenarios (RCP 4.5), to a high emission scenario (RCP 8.5). These projections can be found on the Canadian Centre for Climate Services website. Guidance from the U.S. Office of Planning and Research suggests that to ensure that long-lived infrastructure is planned, and may eventually need to be built, operated and maintained, to withstand future impacts from climate change associated with the "business-as-usual" or high emissions pathway, currently RCP 8.5.

3.5 Determining the Level of Risk Analysis

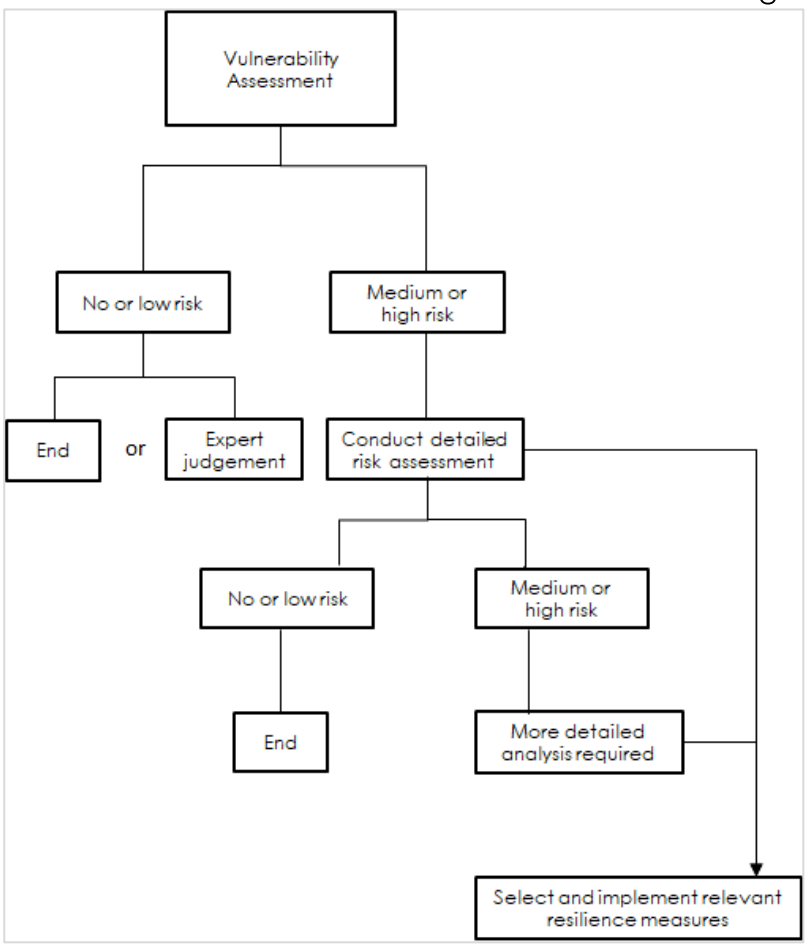
This guidance is designed to accommodate a wide array of assessments and varying levels of complexity. In some cases, the climate change resilience assessment will be applied to assets whose primary purpose is to help communities adapt and be more resilient to current and

future climate change hazards. In other cases, the assessment may be applied to projects that have different primary purposes, such as public transit. Moreover, assessments will be undertaken across different geographies and climate zones, under different climate hazards and for a variety of sectors (e.g., energy, transport, buildings, etc.). Not all projects, therefore, will require the same depth of analysis when conducting a resilience assessment.

Infrastructure Canada recognizes that responsibility is vested in the professional judgement of licensed professional engineers, registered planners, specialized biologists or hydrologists to determine the necessary level of detail for assessments, so long as they meet the requirements outlined in this guidance document.

An assessment's level of effort, formality and documentation should be commensurate to the level of risk of the project, including its size, criticality and vulnerabilities. More information about what, at a minimum is required as part of a vulnerability assessment, and what projects require detailed risk assessments can be found in Annex G.

Figure 1: Flowchart of Resilience Assessment



A vulnerability assessment may be sufficient in identifying that a project does not face significant climate change risks or it could identify that there is a need to conduct a more detailed assessment.

The following questions may help in considering the depth of analysis required:

- Are you building or retrofitting an asset in an area that has already been impacted by a natural hazard or other climate risk (e.g. near a body of water with potential for flooding, near a potential wildfire-urban interface)?
- Could the asset you are building or retrofitting be compromised if certain climate-sensitive conditions changed (e.g., thawing permafrost, coastal inundation, increasing freeze-thaw variability)?
- Is the asset you are building or retrofitting of critical importance to the community it serves[1]?
- Is your project of national significance, e.g. a project that could benefit more than one province or territory, a project that would mitigate a significant economic loss in case of disaster, or a project that could mitigate loss of life?

If your answer to any of these questions is YES, Infrastructure Canada requires you conduct a more detailed resilience assessment.

[1] Public Safety Canada defines critical infrastructure as: "Processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government. Critical infrastructure can be stand-alone or interconnected and interdependent within and across provinces, territories and national borders. Disruptions of critical infrastructure could result in catastrophic loss of life, adverse economic effects and significant harm to public confidence."

3.6 Required Information and Data Points

The following section provides a breakdown of the information you will need to provide to Infrastructure Canada as part of the climate resilience assessment. It should be noted that for the Disaster Mitigation and Adaptation Fund, the resilience assessment has been incorporated within the full application process for all projects.

- If your vulnerability assessment concludes that there are no or low significance climate change risks associated with your project, your assessment must still identify the process you have undertaken, evidence base and the conclusions of your assessment.

- If medium or high risks have been identified, the following must be included in the assessment: an analysis of risk, consequence, likelihood, and vulnerability should be undertaken and described; risk treatment measures considered and/or integrated should be described (e.g., a change to the location or the design of an asset, the incorporation of natural infrastructure, the addition of a flexible design, etc.); and the evidence base must be presented.

- A rationale must be provided for any risk treatment measures identified but not selected for implementation.

This information will be made public at an aggregate level on Infrastructure Canada's website, to transparently communicate with the Canadian public on progress in addressing climate change impacts. Infrastructure Canada will ensure that no sensitive information is released.

3.6.1 Identification and Assessment of Climate Change Risk(s) (see Annex G for further information)

Each risk should be assessed using the following order and naming convention:

(a) Climate change hazard
(b) Impact on asset (reflects vulnerability)
(c) Consequence of impact

For example, (a) flooding exacerbated by climate change (b) impaired operation of a wastewater treatment plant and interrupted service (c) which resulted in increased risk to public health.

Each climate change hazard and impact may have several consequences and it is important that these risks be identified *separately*. This will allow each risk to be rated separately to reflect any potential differences in priority. For example, riverine flooding may have catastrophic consequences from an economic perspective but be only of moderate consequence from a public safety perspective.

Risk identification should include, as appropriate, consideration of impacts from extreme events (e.g., increased storm intensity, heat waves, etc.) as well as impacts resulting from *incremental or slow onset* events (e.g., increased drought, sea-level rise, permafrost thaw, etc.).

Risk identification should include, as required, consideration of cascading *and* cumulative impacts. For example, a direct impact would be flooding or inundation damaging critical infrastructure which reduces public safety. An example of an indirect impact would be flooding or inundation damaging roads, which in turn prevent normal traffic flow in affected areas.

3.6.2 Analysis of Risk, Consequence, Likelihood, and Vulnerability (see Annex G for further information)

The assessment must identify the magnitude of the consequence of an event and its likelihood of occurring. The consequence and likelihood should be considered in the context of:

- the climate change scenario(s) being considered; and
- the existing controls to manage the risk.

3.6.3 Risk Treatment or Adaptation Measures to be Taken (see Annex G for further information)

In narrative form, the assessment must identify which risk treatment or adaptation measures (e.g. changes to location, design, operation and/or maintenance) have been analyzed, and which, if any, will be implemented and why — including the projected change in resilience as a result. Identify particular risks that are not being addressed and explain why. Anticipated residual risk following risk treatment measures should be identified. Cost considerations where applicable should be noted.

For adaptation, resilience or disaster mitigation focused projects, proponents must identify the return on investment of the project. Applicants are encouraged to clearly demonstrate the following two steps associated with the Return on Investment (ROI):

1. Loss Estimation Analysis; and
2. Return on Mitigation Investment.

Further Guidance on return on investment is available in Annex G.

3.6.4 Description of Evidence Base

Assessments must clearly describe both the data sources used to identify and evaluate the risks (e.g. climate scenarios, flood maps, projections, etc.) as well as information garnered through engagement and input from stakeholders.

4. QUALITY ASSURANCE

Both the GHG mitigation assessment and climate change resilience assessment will require an attestation of the qualification of the party completing the assessment and of the assessment's conformity with the guidance.

GHG mitigation assessments must be carried out by a qualified party (i.e., a professional engineer, or a GHG accounting professional with suitable GHG quantification training or expertise related to the project. This individual or firm would be required to provide an attestation confirming that the concerned party is qualified to conduct the assessment, and that the assessment conforms to the guidance provided by Infrastructure Canada. The professional preparing the assessment and the attester may be the same individual.

In the context of climate change resilience assessments, Infrastructure Canada will similarly require that a professional engineer, registered planner, or specialized biologist or hydrologist attest that the concerned party holds the necessary qualifications to conduct the assessment, and that the assessment complies with the relevant Climate Lens guidance. The professional preparing the assessment and the attester may be the same individual.

For both assessment types, attestations must be submitted at the same time as the assessment.

Annex A – Sample Table of Contents for GHG Mitigation Assessments

This notional table of contents is provided for informational purposes only. While the following topics should be addressed within the GHG Mitigation Assessment in order to comply with the requirements outlined in the relevant guidance document(s), Applicants are not obligated to specifically structure their reports in this manner.

1. Attestation of Completeness

2. Executive Summary

3. Introduction / Project Overview

4. Methodology
    a. Boundary of the assessment
    b. Greenhouse gases considered
    c. Emission scopes
    d. Data collection and calculation procedures
    e. Exclusions from the assessment
    f. Assumptions

5. Baseline Scenario
    a. Construction
    b. Operations & Maintenance

6. Estimated Project Emissions
    a. Construction
    b. Operations & Maintenance

7. Estimated Net Increase or Reduction in Emissions

8. Other Potential Mitigation Measures (*optional component*)
    a. Options for avoidance of impacts

b. Options for mitigation of impacts

9. Estimated Cost-Per-Tonne (*Climate Change Mitigation sub-stream only*)

10. Conclusion

11. Bibliography / References

Annex B – Attestation Template for GHG Mitigation Assessments

I/we the undersigned attest that this GHG Mitigation Assessment was undertaken using recognized assessment tools and approaches (i.e., *ISO 14064-2: Specification with guidance at the project level for quantification, monitoring, and reporting of greenhouse gas emissions reductions or removal enhancements* and, if chosen, the *GHG Protocol for Project Accounting*) and complies with the General Guidance and any relevant sector-specific technical guidance issued by Infrastructure Canada for use under the Climate Lens.

Prepared by: _____ _____

[Name and credentials] [Date]

Attested by*: _____ _____

[Name and credentials] [Date]

*GHG Mitigation Assessments must be prepared by a qualified party (i.e., a professional engineer, or a GHG accounting professional with suitable GHG quantification training or expertise related to the project.

Annex C – Global Warming Potentials for GHG Mitigation Assessments

Source: Canada's National Inventory Report. As GWPs may be updated from time to time, please ensure you are using the most recent figures.

GHG	Formula	100-Year GWP
Carbon Dioxide	CO_2	1
Methane	CH_4	25
Nitrous Oxide	N_2O	298
Sulphur Hexafluoride	SF_6	22 800
Nitrogen Trifluoride	NF_3	17 200
Hydrofluorocarbons (HFCs)		
HFC-23	CHF_3	14 800
HFC-32	CH_2F_2	675
HFC-41	CH_3F	92
HFC-43-10mee	$CF_3CHFCHFCF_2CF_3$	1 640
HFC-125	CHF_2CF_3	3 500
HFC-134	CHF_2CHF_2	1 100
HFC-134a	CH_2FCF_3	1 430
HFC-143	CH_2FCHF_2	353
HFC-143a	CH_3CF_3	4 470
HFC-152	CH_2FCH_2F	53

GHG	Formula	100-Year GWP
HFC-152a	CH_3CHF_2	124
HFC-161	CH_3CH_2F	12
HFC-227ea	CF_3CHFCF_3	3 220
HFC-236cb	$CH_2FCF_2CF_3$	1 340
HFC-236ea	CHF_2CHFCF_3	1 370
HFC-236fa	$CF_3CH_2CF_3$	9 810
HFC-245ca	$CH_2FCF_2CHF_2$	693
HFC-245fa	$CHF_2CH_2CF_3$	1 030
HFC-365mfc	$CH_3CF_2CH_2CF_3$	794
Perfluorocarbons (PFCs)		
Perfluoromethane	CF_4	7 390
Perfluoroethane	C_2F_6	12 200
Perfluoropropane	C_3F_8	8 830
Perfluorobutane	C_4F_{10}	8 860
Perfluorocyclobutane	c-C_4F_8	10 300
Perfluoropentane	C_5F_{12}	9 160
Perfluorohexane	C_6F_{14}	9 300
Perfluorodecalin	$C_{10}F_{18}$	7 500
Perfluorocyclopropane	c-C_3F_6	17 340

Annex D – Sample Table of Contents for Resilience Assessments

This notional table of contents is provided for informational purposes only. While the following topics should be addressed within the Resilience Assessment in order to comply with the requirements outlined in the relevant guidance document(s), proponents are not obligated to specifically structure their reports in this manner.

1. Attestation of Completeness

2. Executive Summary

3. Introduction / Project Overview

4. Methodology
    a. Scope and timescale of the assessment
    b. Identification and assessment of climate hazards
    c. Impact(s) on asset
    d. Consequence(s) of impact

5. Analysis of Resilience Options
    a. Identification of risk treatment measures identified for each impact
    b. Cost/benefit analysis
    c. Consideration of resilience principles
    d. Additional Co-benefits (*optional component*)

6. Risk Treatment Measures Selected (or not) and Justification

7. Projected Return on Investment (Loss Avoided in relation to the Project Cost) (*for adaptation, resilience or disaster mitigation projects)*

8. Description of Evidence Base (including Indigenous knowledge)

9. Conclusion

10. Bibliography / References

Annex E – Attestation Template for Resilience Assessments

I/we the undersigned attest that this Resilience Assessment was undertaken using recognized assessment tools and approaches (i.e., *ISO 31000:2009 Risk Management—Principles and Guidelines)* and complies with the General Guidance and any relevant sector-specific technical guidance issued by Infrastructure Canada for use under the Climate Lens.

Prepared by: _____ _____

[Name and credentials] [Date]

Attested by*: _____ _____

[Name and credentials] [Date]

*Resilience Assessments must be prepared, or at a minimum validated by, a licenced professional engineer, certified planner, or appropriately specialized biologist or hydrologist.

Annex F - Climate Change Resilience Principles

The following guiding principles should be reflected when conducting the assessment and management of the climate risk component of the Climate Lens.

The principles are derived from international agreements such as the Sendai Framework for Disaster Risk Reduction and Canada's National Strategy for Critical Infrastructure which both emphasize resilience as a way to mitigate disasters and natural hazards. They are also informed by Canada's Federal Adaptation Policy Framework and national climate knowledge assessments produced by Natural Resources Canada.

1. *Proportionate Assessment*

The level of effort and detail in assessing risk and identifying solutions should reflect: the project cost and scope, how vulnerable the asset is to climate impacts, and how important the asset is to providing or protecting essential services (criticality of asset).

2. *Systemic Analysis of Risk*

A holistic approach should assess climate hazards according to likelihood and consequence, based on best available science and data (including historical data and future climate projections), asset vulnerability, and also consider infrastructure interdependencies. A network perspective considers dependencies and interdependencies, when appropriate. An impact to a single asset can result in significant damage on a city-wide, regional, national or even international scale. It is important to understand the nature and location of other assets that could be affected by a failure of the targeted asset; work with other relevant asset owners when possible. Priority-setting of possible measures should consider redundancy, prioritize no-regrets options and avoid locking-in costly decisions that narrow future options.

3. *Pursuit of Multiple Benefits*

Opportunities should be maximized to provide many benefits, e.g., considering synergies with greenhouse gas emissions reduction. Adaptation initiatives that are not GHG-intensive should be strongly considered. Increasing emissions to address climate impacts (e.g., use of fossil-fuel powered air conditioning to counter extreme heat) may be avoided through a detailed assessment of different options to clarify potential GHG impacts of adaptation actions. Consider natural infrastructure. It is becoming increasingly clear that natural assets and engineered or enhanced natural assets can cost-effectively complement or help deliver

infrastructure services (particularly regarding stormwater management, wastewater, potable water and disaster mitigation).

4. *Avoidance of Unintended Consequences*

Seeking to avoid risk transference from one asset to others, preserving decision-making flexibility over the long-term (to accommodate new technologies and information), and pursuing no-regrets approaches and first-order solutions. Climate resilience initiatives inescapably face uncertainty given the broad range of projected future climate change impacts. Pursuit of enduring solutions should be prioritized and displacement of costs (e.g., causing greater flooding to happen downstream) should be avoided.

Annex G – Methodologies and Resilience Assessment Steps

Disclaimer: Note that the list of resources identified below is not exhaustive, inclusion of a resource on this list does not entail it is the most up-to-date version. Proponents are ultimately responsible for obtaining the best quality information.

Methodologies to assess climate change risk and resilience consistent with ISO 31000

- Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol: https://pievc.ca/
- Envision: https://sustainableinfrastructure.org/envision/
- SuRe – The Standard for Sustainable and Resilient Infrastructure: http://www.gib-foundation.org/sure-standard/

Steps of Climate Risk Assessment Process

The following provides broad guidance for the steps typically included when conducting a Risk Assessment. This step-by-step guidance can be scaled up or down based on the nature of the asset and complexity of the assessment. These steps are adapted from those published in the Canadian Climate Change Risk Assessment Guide – A Strategic Overview of Climate Risks and Their Impact on Organizations (2014).

Tables included in the Climate Risk Assessment process should be viewed as examples only, and modified by Applicants to fit the assessment context.

1. Establishing the Context (Scope)

A preliminary vulnerability assessment should be conducted, focusing on identifying sensitivities of the asset to climate change and weather related risks and exposure to future hazards caused by climate change. This step should also include learning from past project experience of weather and climate impacts, with a specific emphasis on incorporating the guidance from Indigenous historical knowledge of the area, including challenges faced during responses and recovery to the impacts of climate-related events. This preliminary assessment may conclude

that your project has no climate change-related risks and that no further action is required – or it could identify key risks you should investigate further.

Potential preparatory activities include:

- Understanding historical climate data and future climate projections for the area(s) of interest and the associated exposure of the asset to the baseline climate risks and future climate change;
- Ensuring clarity about the objectives, timeframe and resources available for assessment; and
- Development of a work plan.

Expected Results and Outputs:

- Project objectives and timelines identified.
- Project team established.
- Those individuals or groups that may be affected or involved have been identified and preliminary analysis of their needs, concerns and probable issues completed including in partnership with relevant Indigenous groups.
- Communications or dialogue with groups that may be affected has been considered.
- Collection of records and documentation begun.

2. Risk Identification

This is the beginning of the risk assessment part of the process. The sequence of risk events and/or slow climate onset events resulting from climate change impacts are carefully assessed and given a preliminary examination. This is done by:

- Identifying both the current and projected climate change impacts and the associated potential risks to the asset, system and surrounding environment.
- Identifying risk owners for each potential risk.
- Conducting a preliminary analysis of these risk events to determine in a very general sense their likelihood and possible consequences.
- Considering which risks present a minimal level of risk and can be discarded from further consideration.

Key resources to identify climate change projections and other relevant climate data for your region can be found in Annex H – Resources.

Expected Results and Outputs

- Risks are identified and a preliminary analysis is completed for each event showing initial estimates of potential consequences or benefits and likelihood.
- Existing control measures are identified; as are preliminary thoughts about potential additional adaptation or control measures.
- Baseline information has been collected, or plans have been made to collect baseline information including the incorporation of Indigenous knowledge and guidance.
- Additional analysis of other organizations, governments, people or other groups who might be affected by the risks has been completed.

3. Risk Analysis

In this step more detailed consideration is given to the likelihood and consequences of the climate change risk events and opportunities that were selected in Step 2. One of the final tasks that was carried out in the previous step was to discard from further consideration risk events that were assessed as being negligible, very low or low risk levels.

Expected results and outputs

- Estimates of likelihood and consequences of risk events and opportunities.
- Presentation of likelihood and consequence estimates in a format that is easy-to-understand by non-experts.
- Estimates of the acceptance of risk stakeholders, or a record of reasons for non-acceptance, based on a dialogue with the stakeholders and a careful documentation of their perception of the risks.

4. Risk Evaluation

In this step, a process for comparing or ranking each risk event is developed. This is done by:

- Confirming the overall likelihood and consequence rating that was carried out in Step 3 including costs, benefits and acceptability. The overall rating should also consider any downstream effects identified.
- Identifying unacceptable risks and ranking them for risk reduction or control measures.
- Opportunities have also been rated in Step 3 in a more general way by their likelihood and potential benefits. These should be confirmed in Step 4 and the opportunities ranked in some order of importance for exploitation.

The following are suggested tables proponents can use or build on to estimate likelihood of risks, estimates of consequences of risks and a risk evaluation matrix.

Table 1: Estimates of Likelihood of Risks

Probability Range Type of Event	Very Low	Low	Moderate	High	Very High
Event(s)	**Not likely to occur in period**	**Likely to occur once between 30 and 50 years**	**Likely to occur once between 10 and 30 years**	**Likely to occur at least once a decade**	**Likely to occur once or more annually**
On-going / Cumulative Occurrence	Not likely to become critical/beneficial in period	Likely to become critical/beneficial in 30-50 years	Likely to become critical/beneficial in 10-30 years	Likely to become critical/beneficial in a decade	Will become critical/beneficial within several years

Note: Use as many rows as needed to include the selected risk events.

Table 2: Estimates of Consequences of Risks

(Use one table for each risk event)

Factor Degree	People				Economic			Environment			
	Health & Safety	Displacement	Loss of Livelihood	Reputation	Infrastructure Damage	Financial Impact on Proponent	Financial Impact on Stakeholders	Air	Water	Land	Ecosystems
Very Low											
Low											
Moderate											
High											
Very High											

Note: The project team should modify the columns to include the consequences that they consider significant, for example some may wish to include legal liability or differentiate between capital and operating costs.

Table 3: Risk Evaluation Matrix

Consequences	Very High	Moderate Risk	High Risk	High Risk	Extreme Risk	Extreme Risk
	High	Low Risk	Moderate Risk	High Risk	High Risk	Extreme Risk
	Moderate	Low Risk	Low Risk	Moderate Risk	High Risk	High Risk
	Low		Low Risk	Low Risk	Moderate Risk	Moderate Risk
	Very Low			Low Risk	Low Risk	Low Risk
		Very Low	Low	Moderate	High	Very High
	Likelihood					

Extreme Risk (Red): Immediate controls required

High Risk (Orange): High priority control measures required

Moderate Risk (Yellow): Some controls required to reduce risks to lower levels

Low Risk (Blue): Controls likely not required

Negligible Risk (Green): Risk events do not require further consideration

Expected results and outputs

- Risks evaluated in terms of likelihood, consequence, with some sense of costs and benefits.
- Risks ranked or prioritized.
- Unacceptable risks identified.
- Possible risk treatments or adaptation measures have been recorded for consideration in Step 5.

5. Risk Treatment and Adaptation Measures

In Step 4 the climate change impacts and the possible risk events or opportunities they could create were evaluated and ranked. Consideration was given to how acceptable the risks were to the organization and principal people or groups that may be affected or involved. For unacceptable risks, consideration was given to potential risk treatment or adaptation measures. Also opportunities were identified and examined for how they could be exploited. This is only required for projects in the Adaptation, Resilience and Disaster Mitigation sub-streams.

In this step:

- Risk treatment or adaptation measures will be identified for reducing unacceptable risks to acceptable levels and examined for feasibility.
- Potential opportunities will be considered further for exploitation, where applicable.

- The effectiveness of the risk treatment or adaptation measures will be evaluated including the costs (both operating and capital), benefits and associated implementation risks.
- Return on Investment will be calculated where possible.
- Optimal adaptation strategies and opportunity exploitation measures will be selected and consideration will be given to the acceptability of residual risks.

Table 4 – Risk Treatment and Adaptation Measures

Risk Event	Adaptation Measure or Risk Treatment (use as many rows as needed for each event)	Timeframe	Cost	Effectiveness	Acceptability	Comment/ Evaluation

Expected results and outputs

- Feasible risk treatment options are identified.
- An adaptation plan is outlined for the implementation of risk treatment and adaptation measures.
- The potential opportunities and how they can be exploited has been considered.
- Optimal solutions are chosen.

Return on Investment Guidelines

These return on investment guidelines are adapted from Public Safety Canada's National Disaster Mitigation Program. This is only required for projects in the Adaptation, Resilience and Disaster Mitigation substreams.

Project proponents can use any recognized methodology for determining the Return on Investment (ROI) of the proposal. However, applicants are encouraged to clearly demonstrate the following two steps associated with the ROI:

1. Loss Estimation Analysis; and
2. Return on Resilience Investment.

All costs associated with the ROI calculation should be based on the direct losses that would be incurred if the proposed project was not undertaken. Similarly, only costs that can be directly attributed to the proposed adaptation or resilience activity should be used in assessing the ROI.

Loss Estimation Analysis

Loss Estimation Analysis (LEA) determines the dollar value estimate of the damage that would have resulted from the identified hazard(s), were the project not to be completed versus the costs that would be incurred if the project were to be completed. The losses (damages) are calculated for scenarios where no adaptation actions are taken for a given event. Similarly, the losses (damages) are calculated for the same event if the project were completed. The difference between the costs associated with each of the two scenarios determines the estimated loss avoided (in dollars).

The loss estimation analysis can be presented as follows:

$RP_A - RP_C = LA$

Where:
RP_A = Resilience Project Absent
RP_C = Resilience Project Complete
LA = Loss Avoided

Categories of loss generally include physical damage to assets and infrastructure, loss of function, and emergency management costs.

Table 5: Loss estimation categories and types

Loss Type	Loss Category
Physical	Buildings Contents Roads and Bridges Landscaping Environmental Impacts Vehicles/Equipment

Loss of Function	Displacement Expense Loss of Rental Income Loss of Business Income Loss of Wages Disruption Time of Residents Loss of Public Services Economic Impact of Utility Loss Economic Impact of Road/Bridge Closure
Emergency Management	Debris Cleanup Government Expense

(FEMA 2007)

Finally, all losses avoided should be calculated in present-day values.

Return on Investment

The return on investment (ROI) is calculated using the Loss Avoided (calculated above) in relation to the proposed Project Cost (PC). These results can vary depending on the number of events evaluated for different assets and the resulting level of damage. For instance, if the resilience measure is determined to protect an asset or community from more than one event during the course of the amortization period, the multiple cost avoidance should be calculated.

The proposed Project Cost (PC), is the total investment estimated for the project being evaluated, or in the case of acquisition projects, the fair market cost to acquire and restore the property. Project cost should represent the total investment for the project made by all parties involved.

Based on the information from the Loss Avoided and the determination of the Project Cost, the ROI should represent the following:

$$\frac{\text{LA (\$)}}{\text{PC (\$)}} = (\%)\text{ROI}$$

Where:
LA ($) = Loss Avoided in dollars
PC ($) = Project Cost in Dollars
ROI = Return on Investment (percentage)

Amortization

All ROI calculations should be amortized over the average useful life of the asset. Clearly indicate the proposed timeframe.

Annex H – Resources for Resilience Assessments

The following is a list of resources to support proponents with their climate change resilience assessment. It includes references to national and regional climate service providers, climate data portals, and other sources of climate data and information across the country.

Resources that are relevant to assessing the climate resilience of infrastructure are also listed below, including climate data sets relevant for professional engineers, broader assessments on adaptation conducted by the federal government and climate and community risk assessment tools that may help inform a resilience assessment.

Please note that this list is not exhaustive and that the inclusion of a resource does not mean it is current or the best and most detailed information available. For example, local governments may have more detailed flood maps that should be used.

These resources will be updated as more become available.

Canadian Centre for Climate Services

The Government of Canada's Canadian Centre for Climate Services (CCCS) was established so that Canadians have the information and support they need to understand and reduce the risks posed by climate change. The CCCS provides access to climate data, tools, and information from across the country, and strives to provide authoritative, timely, and relevant climate services by working in partnership with federal government departments, different levels of government, and regional climate organizations including the Pacific Climate Impacts Consortium and Ouranos.

To ensure the right audience has access to the right tool, the CCCS has supported a suite of data portals that are useful for Canadians looking for an entry-level understanding of climate change trends, informed decision-makers that need high-resolution data, and researchers with climate science backgrounds looking to collaborate and share information. The portals include:

- Climate Atlas of Canada: https://climateatlas.ca/home-page
- ClimateData.ca: https://climatedata.ca
- Platform for the Analysis and Visualization of Climate Science: https://ouranosinc.github.io/pavics-sdi/

Access to these data portals is available through the CCCS website, Canada.ca/climate-services. This website includes a library of climate resources, describes key climate concepts, provides climate information basics, and the ability to view mapped climate data or to download subsets of climate data from a selection of Environment and Climate Change Canada's datasets.

The CCCS helps guide Canadians in the understanding and use of climate data by providing direct access to climate experts through the Climate Services Support Desk. The Support Desk can be reached by phone at 1-833-517-0376, by email at info.cccs-ccsc@canada.ca, or through the CCCS website. Please check the CCCS website on a regular basis as new tools and resources become available.

National Climate Data and Resources

Environment and Climate Change Canada Climate Datasets

- Canadian Climate Data and Scenarios: http://climate-scenarios.canada.ca/?page=main
- Canadian Gridded Temperature and Precipitation Anomalies (CANGRD): https://open.canada.ca/data/en/dataset/3d4b68a5-13bc-48bb-ad10-801128aa6604
- Adjusted and Homogenized Canadian Climate Data AHCCD: https://open.canada.ca/data/en/dataset/9c4ebc00-3ea4-4fe0-8bf2-66cfe1cddd1d
- Canadian Climate Normals and Averages: http://climate.weather.gc.ca/climate_normals/
- Canadian Historical Climate Data : http://climate.weather.gc.ca/historical_data/search_historic_data_e.html
- Engineering Climate Datasets: http://climate.weather.gc.ca/prods_servs/engineering_e.html

The CANGRD and AHCCD datasets, climate normals, and daily historical climate data from select weather stations can also be viewed through an interactive map and downloaded from the CCCS website.

ClimateData.ca also provides interactive access to daily historical climate data, and intensity-duration-frequency (IDF) curves available under Engineering Climate Datasets.

Natural Resources Canada Datasets

- Federal Geospatial Platform: https://gcgeo.gc.ca/en/index.html
- Canadian Forestry Service: https://cfs.nrcan.gc.ca/projects/3

Other national datasets

- Climate Change Hazards Information Portal (CCHIP): http://cchip.ca/

Regional Climate Data

- Atlantic Climate Adaptation Solutions Association: https://atlanticadaptation.ca/

- Canadian Climate Data and Scenarios: http://climate-scenarios.canada.ca/?page=main
- New Brunswick's Future Climate Data : http://acasav2.azurewebsites.net/
- Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR): http://climateontario.ca/
- Ouranos (Québec): https://www.ouranos.ca/
- Pacific Climate Impacts Consortium (British Columbia): https://www.pacificclimate.org/
- Pacific Climate Centre: http://prairieclimatecentre.ca/
- Turning Back The Tide, Newfoundland and Labrador, Climate Data and Tools: http://www.turnbackthetide.ca/tools-and-resources/climate-data-and-tools.shtml

Provincial and Territorial Flood Maps

- British Columbia: http://www.env.gov.bc.ca/wsd/data_searches/fpm/reports/index.html
- Alberta: http://maps.srd.alberta.ca/FloodHazard/
- Manitoba: https://www.gov.mb.ca/mit/floodinfo/floodoutlook/watersheds_data_maps.html
- Ontario: https://www.ontario.ca/law-and-safety/flood-forecasting-and-warning-program
- Québec: https://www.cehq.gouv.qc.ca/zones-inond/carte-esri/index.html
- New Brunswick: http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/flood/flood_maps.html
- Newfoundland and Labrador: http://www.mae.gov.nl.ca/waterres/flooding/frm.html

Federal Flood Mapping Guidelines

These are a series of evergreen guidelines that will help advance flood mapping activities across Canada. The publication of these documents will contribute to better addressing overland flooding – Canada's costliest hazard – by strengthening flood mapping across the country.

- Federal Flood Mapping Framework (Version 2.0): https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=308128
- Federal Airborne LiDAR Data Acquisition Guideline (Version 2.0): https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=308382
- Bibliography of Best Practices and References for Flood Mitigation (Version 2.0): https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=308380

- Case Studies on Climate Change in Floodplain Mapping (Version 1.0): https://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=306436

Climate Risk Assessment & Climate Change Adaptation Planning Guides & Resources

- Federation of Canadian Municipalities' Municipalities for Climate Innovation Programme: https://fcm.ca/home/programs/municipalities-for-climate-innovation-program/municipalities-for-climate-innovation-program.htm
- ICLEI's Changing Climate, Changing Communities Framework (BARC Tool): a milestone framework that guides local government practitioners through a process of initiation, research, planning, implementation and monitoring for climate adaptation planning. It is available through a subscription with ICLEI: https://icleicanada.org/barc-program/
- Atlantic Canada Climate Adaptation Solutions Association: 7 Steps to Assess Climate Change Vulnerability in Your Community: http://atlanticadaptation.ca/
- SaskAdapt – Self-Assessment Tool: http://www.parc.ca/saskadapt/self-assessment-tool.html
- Canadian Institute of Planning: https://www.cip-icu.ca/ClimateChangePolicy (here you will find a significant number of climate change adaptation plans and resources)

Federal Assessments to Assess Climate Change Impacts and Risks and develop Adaptation Measures

Assessments in the Canada in a Changing Climate: *Advancing our Knowledge for Action*, a national assessment of how Canada's climate is changing, the impacts of these changes on its communities, environment and economy, and how it is adapting to reduce climate-related risks.

- *Canada's Changing Climate Report 2019:* https://changingclimate.ca/CCCR2019/ The Report is about how and why Canada's climate has changed, and what changes are projected for the future.
- Canada in a Changing Climate: National Issues
- Canada in a Changing Climate: Regional Perspectives

Climate Risks & Adaptation Practices for the Canadian Transportation Sector 2016:
http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2017/19623
The report presents the current state of knowledge about climate risks to the Canadian transportation sector, and identifies existing or potential adaptation practices. The report

includes six regional chapters and one urban chapter which reflect the different climate change impacts, vulnerabilities and opportunities across Canada.

Canada's Marine Coasts in a Changing Climate:
http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2016/18388
This document assesses climate change sensitivity, risks and adaptation along Canada's marine coasts. The report includes overviews of regional climate change impacts, risks and opportunities along Canada's three marine coasts, case studies demonstrating action, and discussion of adaptation approaches.

Climate data and scenarios: synthesis of recent observation and modelling results:
https://www.canada.ca/en/environment-climate-change/services/climate-change/publications/data-scenarios-synthesis-recent-observation.html
This document provides a brief overview of the most up-to-date analysis of historical climate observations and future climate projections focusing specifically on Canada. The current document is intended as a resource for dissemination of climate information with a specific focus on historical and future climate change across Canada. It is not intended to serve as a definitive reference or complete characterization, and readers are directed to the underlying data sources for more detailed and quantitative analyses specific to their climate impact, adaptation, or environmental assessment context.

Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (2014):
http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309
An update to the 2008 report, From Impacts to Adaptation: Canada in a Changing Climate. The report assesses literature published since 2007 on climate change impacts, adaptation and vulnerability in Canada. It includes chapters on natural resources, food production, industry, biodiversity and protected areas, human health, and water and transportation infrastructure.

From Impacts to Adaptation: Canada in a Changing Climate (2008):
http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/10253
Assesses risks and opportunities presented by climate change, and actions being taken to address them, from a regional perspective.

Adaptation Solutions

Adapting to Climate Change in Coastal Communities of the Atlantic Provinces, Canada: Land Use Planning and Engineering and Natural Approaches:
https://atlanticadaptation.ca/en/islandora/object/acasa%253A789

Other Resources

- Canadian Society of Landscape Architects Adaptation Primers:
    - Primer 1: Canada's Changing Climate: http://www.csla-aapc.ca/sites/csla-aapc.ca/files/Climate/VOLUME%201%20Canada's%20Changing%20Climate%202018.pdf
    - Primer 2: Preparing for Change: http://www.csla-aapc.ca/sites/csla-aapc.ca/files/Climate/VOLUME%202%20Preparing%20for%20Change%202018.pdf
    - Primer 3: Creating Resilient Communities: http://www.csla-aapc.ca/sites/csla-aapc.ca/files/Climate/VOLUME%203%20Creating%20Resilient%20Communities%202018.pdf
    - Primer 4: Facing Rising Waters: http://www.csla-aapc.ca/sites/csla-aapc.ca/files/Climate/VOLUME%204%20Facing%20Rising%20Waters%202018.pdf
- Engineers Canada's National Guideline: Principles of Climate Adaptation and Mitigation for Engineers: https://engineerscanada.ca/publications/national-model-guide-principles-of-climate-change-adaptation-for-professional-engineers
- American Society of Civil Engineer, Climate-Resilient Infrastructure: Adaptive Design and Risk Management, https://ascelibrary.org/doi/book/10.1061/9780784415191 (for purchase)
- US Environmental Protection Agency, Green Infrastructure Resources: https://www.epa.gov/green-infrastructure
- Free and open LiDAR data: https://canadiangis.com/free-canada-lidar-data.php
- Canada's Core Public Infrastructure (CCPI) Survey: https://www.infrastructure.gc.ca/plan/ccpi-ipec-eng.html
- Representative Concentration Pathways (RCPs): http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html

Annex I: Glossary

Adaptation	Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. Actions / measures that reduce the negative impacts of climate change, while taking advantage of potential new opportunities.
Asset Dependency	One-directional reliance of an asset, system, network, or collection thereof, within and/or across sectors, on input, interaction, or other requirement from other sources in order to function properly.
Asset Interdependency	Mutual, shared or reciprocal dependencies.
Assessment Boundary	The required scope and/or limits of the assessment. In the context of a greenhouse gas assessment, specific elements could include the timescale of the assessment, whether construction materials and/or activities are considered, etc.
Attester	Individual with necessary qualifications (see section 4) attesting that the applicant holds the necessary qualifications and that the assessment is complete and consistent with the relevant Climate Lens guidance.
Baseline / Business As Usual (BAU) Scenario	A hypothetical reference case/description of what would have most likely occurred in the absence of a proposed project or any considerations about climate change mitigation. Appropriate baselines are required to ensure reductions are 'additional' – i.e.: the reduction or mitigation activity associated with a project (or the same technologies or practices it employs) would not have been implemented otherwise.
Carbon Dioxide Equivalent (CO_2e)	The universal unit of measurement used to indicate the global warming potential of greenhouse gases. CO2e is used to evaluate the impacts of releasing (or avoiding the release of) different greenhouse gases.
Climate Change	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods.

Climate Change Impacts	The term "impacts" is used primarily to refer to the effects on natural and human systems of extreme weather and climate-related events and of climate change. Impacts generally refer to effects on lives, livelihoods, health status, ecosystems, economic, social, and cultural assets, services (including environmental), and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to as consequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, and sea level rise, are a subset of impacts called physical impacts.
Climate Resilience	The capacity of a community, business, or natural environment to anticipate, prevent, withstand, respond to, and recover from a climate change related disruption or impact.
Climate Scenario	A plausible and often simplified representation of the future climate, based on an internally consistent set of climatological relationships and assumptions of radiative forcing, typically constructed for explicit use as input to climate change impact models. A 'climate change scenario' is the difference between a climate scenario and the current climate.
Co-Benefits	The positive effects that a policy or measure with one objective might have on other objectives, irrespective of the net effect on overall social welfare. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits.
Critical Infrastructure	Critical infrastructures are those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, would have a serious impact on the health, safety, security or economic well-being of citizens or the effective functioning of governments. Critical infrastructure includes: energy installations and networks; communications and information technology; finance (banking, securities and investment); health care; food; water (dams, storage, treatment and networks); transport (airports, ports, intermodal facilities, railway and mass transit networks and traffic control systems); production, storage and transport of dangerous goods (e.g. chemical, biological, radiological and nuclear materials); government (e.g. critical services, facilities, information networks, assets and key national sites and monuments).
Direct Effects	Emissions or removals from GHG sources or sinks that are owned or controlled by the project developer.

Disaster	A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Comment: Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.
Disaster Mitigation	A measure taken to reduce the negative impact of a disaster in order to protect lives, property, and the environment and reduce economic disruption.
Disaster Risk	The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.
Disaster Risk Reduction	Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.
Emission Factor	A factor relating GHG emissions to a level of activity or a certain quantity of inputs or products or services (e.g., tonnes of fuel consumed, or units of a product). For example, an electricity emission factor is commonly expressed as t CO2eq/megawatt-hour.
Exposure	A measure of the spatiotemporal extent (amount of space and time) that a person or asset is in the hazard area.
Extreme Weather Events	Extreme weather includes unexpected, unusual, unpredictable severe or unseasonal weather; weather at the extremes of the historical distribution—the range that has been seen in the past.
Global Warming Potential (GWP)	A factor describing the radiative forcing impact of one mass-based unit of a given GHG relative to an equivalent unit of carbon dioxide (CO_2) over a given period of time.
Greenhouse Gases (GHGs)	Greenhouse gases are gases that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. The seven GHGs tracked through the National Inventory Report are: carbon dioxide (CO2); methane (CH4); nitrous oxide (N2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulphur hexafluoride (SF6); and nitrogen trifluoride (NF_3).
GHG Mitigation	The reduction, removal, or avoidance of GHG emissions from a specific project.
GHG Reduction	A decrease in GHG emissions or an increase in removal or storage of GHGs from the atmosphere, relative to baseline emissions. Primary effects will result in GHG reductions, as will some secondary effects. A project activity's total GHG reductions are quantified as the sum of its associated primary effect(s) and any significant secondary effects (which may involve decreases or countervailing increases in GHG emissions). A GHG project's total GHG reductions are quantified

	as the sum of the GHG reductions from each project activity.
GHG Removal	The total mass of a GHG removed from the atmosphere over a specified period of time through a carbon sink or storage.
GHG Sink	Any process that removes GHG emissions from the atmosphere and stores them. Components of the biosphere, geosphere or hydrosphere with the capability to store or accumulate a GHG removed from the atmosphere by a greenhouse gas sink are called GHG reservoirs.
GHG Source	Any process that releases GHG emissions into the atmosphere.
Hazard (Climate-Related)	The potential occurrence of a natural or human-induced physical event or trend, or physical impact, that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources. In this Guide, the term hazard refers to climate-related physical events or trends or their physical impacts.
Impacts	Refers primarily to the effects on natural and human systems caused by one or more hazards. Impacts generally refer to effects on lives, livelihoods, health status, ecosystems, economic, social, and cultural assets, services (including environmental), and infrastructure due to the interaction of one or more hazard events occurring within a specific time period and the vulnerability of an exposed society or system. The effects on natural and human systems o**f extreme weather and climate events and of climate change.** Impacts generally refer to effects on lives, livelihoods, health status, ecosystems, economic, social, and cultural assets, services (including environmental), and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system. Impacts are also referred to asconsequences and outcomes. The impacts of climate change on geophysical systems, including floods, droughts, andsea level rise, are a subset of impacts called physical impacts.
Indirect Effects	Emissions or removals that are a consequence of a project activity, but occur at GHG sources or sinks not owned or controlled by the project developer.
Intergovernmental Panel on Climate Change (IPCCC)	The Intergovernmental Panel on Climate Change (IPCC) is the international body for assessing the science related to climate change. The IPCC was set up in 1988 by the World Meteorological Organization and United Nations Environment Programme to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation.
Likelihood	The chance of an event or an incident happening, whether defined, measured or determined objectively or subjectively.

National Significance	Projects of national significance include projects that: • Reduce impacts on critical infrastructure, including essential services, from impacts of climate change, disasters triggered by natural hazards, and extreme weather events; • Reduce the amount of critical infrastructure that is at high risk; • Reduce impacts on health and safety of Canadians; • Reduce significant disruptions in economic activity from impacts of climate change, disasters triggered by natural hazards, and extreme weather events; • Reduce costs of recovery and replacement (e.g. to the Government of Canada's Disaster Financial Assistance Arrangements (DFAA)); and • Reduce impact on Canada's vulnerable regions, as identified in the Pan-Canadian Framework on Clean Growth and Climate Change including Indigenous, northern, coastal and remote communities.
Natural Disaster	An event that results when a natural hazard impacts a vulnerable community in a way that exceeds or overwhelms the community's ability to cope and may cause serious harm to the safety, health or welfare of people, or damage to property or the environment.
Natural Hazard	A source of potential harm originating from a hydro-meteorological, environmental, geological or biological event. Note: Examples of natural hazards include tornadoes, floods, glacial melt, extreme weather, wildland fires, earthquakes, tsunamis, etc.
Natural Infrastructure	Existing, restored, or enhanced combinations of vegetation and associated biology, land and water, and naturally occurring ecological process that generate infrastructure outcomes such as preventing and mitigating floods, erosion, and landslides; mitigating effects of extreme heat; and purifying groundwater. Natural infrastructure often serves as a carbon sink.
No-Regret Adaptation Options	Adaptation options (or measures) that would be justified under all plausible future scenarios, including the absence of manmade climate change.
One-Time Effects	Secondary effects related to the construction, installation, and establishment or the decommissioning and termination of the project activity. One time effects are not considered under the current iteration of the Climate Lens.
Organizational-Level Assessment	An assessment of GHG emissions/reductions or resilience to climate impact risk that considers a wider scope of activities under the purview of an organization or entity. This would typically consider areas including (but not limited to) buildings, fleets, emergency services, transportation, land use, as well as access to water, and disposition of wastewater and solid waste. Such assessments typically identify mitigation goals and specific actions that are required to meet those goals.

Pan-Canadian Framework on Clean Growth and Climate Change	The Pan-Canadian Framework on Clean Growth and Climate Change (PCF) is the plan developed with the provinces and territories (PTs) and in consultation with Indigenous peoples to meet our emissions reduction targets, grow the economy, and build resilience to a changing climate. This plan includes a pan-Canadian approach to pricing carbon pollution, and measures to achieve reductions across all sectors of the economy. It aims to drive innovation and growth by increasing technology development and adoption to ensure Canadian businesses are competitive in the global low-carbon economy. It also includes actions to advance climate change adaptation and build resilience to climate impacts across the country.
Project (GHG Assessment)	A specific activity or set of activities being assessed for potential to reduce GHG emissions, increase the storage of carbon, or enhance GHG removals from the atmosphere. A project may be a stand-alone project, or a component of a larger project.
Project (Resilience Risk Assessment)	A specific activity or set of activities being assessed for climate risk. A project may be a stand-alone project, or a component of a larger project.
Project Activity (GHG Assessment)	A specific action or intervention targeted at changing GHG emissions, removals, or storage. It may include modifications or alterations to existing production, process, consumption, service, or management systems, as well as the introduction of new systems.
Project Activity (Resilience Risk Assessment)	A specific action or intervention targeted at making an asset more climate resilient. It may include modifications or alterations to existing production, process, consumption, service, or management systems, as well as the introduction of new systems.
Project-Level Assessment	An assessment of GHG emissions or resilience to climate impact risk that is specific to a set of project activities within the scope of a defined project (see definitions above). This typically refers to a single asset or a series of interrelated assets constructed or rehabilitated as part of a single procurement process.
Proponent	Entity submitting an Application for funding under ICIP and whose project is subject to the Climate Lens.
Public Use or Benefit	Privately or publicly owned infrastructure that provides services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government.
Residual Risk	The risk that is left over after efforts to enhance resilience.
Resilience	Resilience refers to the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.
Return on Investment	Loss Avoided in relation to the Project Cost.

Risk	The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity. Source: UNISDR 2017
Risk Assessment	The overall process of risk identification, risk analysis and risk evaluation.
Risk Transfer	The process of formally or informally shifting the financial consequences of particular risks from one party to another, whereby a household, community, enterprise or State authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.
Scenario	A scenario is a coherent, internally consistent, and plausible description of a possible future state of the world (IPCC, 1994). It is not a forecast; each scenario is one alternative image of how the future can unfold. A projection may serve as the raw material for a scenario, but scenarios often require additional information (e.g., about baseline conditions). A set of scenarios often is adopted to reflect, as well as possible, the range of uncertainty in projections.
Scope 1 Emissions	Used at the inventory level to reference emissions from operations that are owned or controlled by the project proponent.
Scope 2 Emissions	Used at the inventory level to reference indirect emissions from the generation of purchased or acquired electricity, steam, heat or cooling consumed by the asset or project.
Scope 3 Emissions	Used at the inventory level to reference all indirect emissions (not included in scope 2) that occur in the project or asset's value chain, including both upstream and downstream emissions.
Upstream and Downstream Effects (GHG Mitigation)	Secondary effects associated with the inputs used (upstream) or the products or services produced (downstream) by a project activity.
Upstream and Downstream Impacts (Resilience)	A dependency impact where in upstream and downstream relationships anything that happens downstream can have an adverse effect on upstream assets or systems, or vice versa.
Vulnerability	A condition or set of conditions determined by physical, social, economic and environmental factors or processes that increase the susceptibility of an asset or a community to the impact of hazards.