ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA

January 10, 2018 Sent Via Email: ClimateReadyBC@gov.bc.ca

To,
CleanBC Engagements Team

From,
Peter Mitchell, P.Eng.
Director, Professional Practice Standards and Development
Engineers and Geoscientists BC

Re: **Engineers and Geoscientists BC's Feedback on CleanBC: Preparing Together Engagement Opportunity**

Engineers and Geoscientists British Columbia is the regulatory and licensing body for the engineering and geoscience professions in BC. To protect the public, we maintain robust standards for entry to the professions, and comprehensive regulatory tools to support engineers and geoscientists in meeting professional and ethical obligations. If these standards are not met, we take action through our investigation and discipline processes.

Engineers and Geoscientists BC has developed position papers on climate change, both on adaptation and mitigation, and is committed to raising awareness about the potential impacts of the changing climate as they relate to professional engineering and geoscience practice. Engineers and Geoscientists BC is currently developing a Climate Change Action Plan which will enable us to take an appropriate and methodical approach to addressing climate change issues related to the practice of professional engineering and geoscience.

This plan will provide a framework for how Engineers and Geoscientists BC can better support its registrants in their professional practice, as well as allow the association to respond to climate change issues proactively rather than reactively. This will build on the work Engineers and Geoscientists BC has done to date, which has included developing a Climate Change Information Portal with tools and resources, and an evolving portfolio of practice guidelines on the topic of climate change adaptation and mitigation.

Engineers and Geoscientists BC appreciates the work done by provincial government to develop these engagement opportunities and to seek feedback from various stakeholders to bring to focus preparing for the impacts of climate change. The association is pleased to provide feedback on one key area where feedback was sought, namely:

What can you and others do to prepare for impacts from climate change?

In particular, feedback has been focused on what governments and businesses can do prepare for these impacts. This feedback has been developed with input from members of Engineers and Geoscientists BC's Sustainability Committee and Climate Change Advisory Group.

Feedback has been organized in six areas (see Appendix A) that governments and businesses can use to make 'climate considered' decisions in the work that they do. Recommendations provided in these topic areas are focused on general scientific knowledge, rather than information or knowledge specific to engineering, geoscience, individual Projects, or our role as a regulator.

Planning for adaptation and mitigation are complex endeavors, but they are the solutions to combating climate change regardless of the sensitivity in the climate system and the swiftness in reducing emissions. Keeping in mind the overall objectives, it is possible to consider adaptation and mitigation with equal focus, and in many cases synergistically, and it can be done in ways that are proportional to the scientific information available without imposing an undue burden to developers and regulators. BC has great potential to lead Canada and the world in this respect and Engineers and Geoscientists BC commits to doing its part to support these initiatives.

Should you have any comments or queries, please do not hesitate to contact Harshan Radhakrishnan, P.Eng., M.A.Sc., Engineers and Geoscientists BC Manager, Climate Change and Sustainability Initiatives, Professional Practice, Standards and Development directly at 604-412-6054 or hrad@egbc.ca.

Sincerely,

Peter Mitchell, P.Eng.,
Director, Professional Practice Standards and Development
Engineers and Geoscientists BC

Appendix A

Summary of Engineers and Geoscientists BC's Recommendations to Prepare for the Impacts of Climate Change:

1. What needs to be done?

Energy alternatives are needed to replace the fossil fuels we have been using. Energy efficiency and demand-side management are rightfully part of the solution. However, BC will also require more and diversified sources of clean energy. Improvements in hydro energy alone will not suffice. We need to be investing heavily in a distributed and resilient network of alternative energy including solar, wind, geothermal and perhaps other sources where they make the most sense.

In addition, scenarios considered by the IPCC suggest that our carbon emissions will likely overshoot international targets, and we will have to remove emissions in the air to reach them again[1]. While it is understood that reducing carbon emissions from projects could position businesses and governments well to prepare for impacts of climate change[2], because we have a limited carbon budget and limited time[3] to reduce emissions to stop runaway climate change, we may not have time to prepare for impacts from climate change. Negative carbon emissions technologies are a range of technological solutions that either:

- stop carbon dioxide from entering the atmosphere, often by "filtering out" the carbon dioxide en-route to the smokestack of a facility such as a power plant or factory or
- remove carbon dioxide that's already in the air, a process known as "direct air capture."

Maturation of the negative carbon emissions technology and integration of the technology in to the supply chain could stimulate the local economy and assist Canadian businesses in offering products and services to mitigate climate change. It is useful to remember that negative carbon emissions technology is not a silver bullet and can only be successful with the proliferation of demand side reduction policies, and renewable energy technologies.

Recommendation: Consider demand side reduction, emissions reduction, and renewable energy integration strategies by default. Consider how to strategically support negative carbon emissions technology and how to integrate lower carbon intensity products and solutions into business supply chains.

2. How does water management factor into adaptation?

The World Economic Forum ranked water crises as most highly ranked societal risk[4] in its 2019 assessment of global risks, with potential to cause damaging economic and social impacts across entire countries and sectors. Living with climate change will mean coping with the impacts on water, whether too much or too little, and taking the necessary steps to reduce the vulnerabilities of communities and economies. Climate change impacts will have direct consequences for water security. The scale and magnitude of the projected changes and impacts due to sea-level rise have quite a wide range associated with it but approaches to deal with managing impacts, from demand side measures to hard and soft adaptation approaches remain roughly the same regardless of what the future greenhouse gas concentrations will be.

Recommendation: There are a variety of approaches to deal with water management including and not limited to:

- putting Integrated Water Resources Management (also called the 'One-Water' approach) at the center of planning and investment for climate change adaptation,
- promoting investment and implementation that incorporates management, restoration and sustainability of natural infrastructure,
- eco-system-based approaches such as providing room for the river (intended to address flood protection, master landscaping and the improvement of environmental conditions in

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[1] 2018 *IPCC* Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter2_Low_Res.pdf

[2] 2019 *Financial Post* Article https://www.ft.com/content/da48cd04-4b2f-11e9-8b7f-d49067e0f50d

[3] 2018 *Carbon Brief* Article https://www.carbonbrief.org/analysis-how-much-carbon-budget-is-left-to-limit-global-warming-to-1-5c

[4] 2019 World Economic Forum, Global Risks Report http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf

the areas surrounding rivers),

- addressing water sustainability through groundwater recharge, and
- supporting actions to build resilience by having watershed management as a core objective of sustainable infrastructure development.

3. What about Representative Concentration Pathways (RCPs)?

RCPs describe four different 21st century pathways of greenhouse gas (GHG) emissions and atmospheric concentrations, air pollutants emissions and land use. The pathways underpin climate model simulations, and their assumptions ultimately drive the projected changes in climate and subsequent impacts. RCPs allow us to better understand what climate impacts would manifest in the long-term under different hypothetical futures in which various mitigation actions are undertaken[5].

Canada's Clean Growth and Climate Change Commitments on Mid- Century Long-Term Low-Greenhouse Gas Development Strategy brings into focus the 2050 greenhouse gas mitigation goals. While information regarding the importance of the 2050 horizon from the perspective of reducing emissions has been well established, the following information on the 2050 horizon from an adaptation perspective could be worth noting:

- The representative concentration pathways indicative of the future atmospheric GHG concentrations do not diverge significantly until the 2050s,
- The 2050s represent a reasonable mid-way period in the lifetime of new buildings and certain new public infrastructure, and importantly,
- We are guaranteed to see changes to the 2050 horizon even with immediate negative carbon emissions due to the inertia in the climate system (essentially means that climate change over the next two or three decades, up to about 2040, will be relatively insensitive to emissions).

From an adaptation perspective, the uncertainty with respect to future greenhouse gas concentrations could limit the ability of decision makers to define their risk tolerance considering the worst-case scenario for longer time horizons (e.g. 2080s). While it is important to consider the longer time horizon on major infrastructure projects, considering the RCP 8.5 scenario of the 2050 horizon, where relevant, can ensure that there is better value for the money spent. Resilience benefits could potentially extend to 2070s provided there are emissions reductions in the near term. Costly overdesign can be avoided through flexibility built into the project for future upgrades.

Recommendation: In preparing for impacts of climate change, the range of RCPs should be considered for a specific situation or Project. This includes considerations of appropriate timelines that are consistent with an individual Project timeline or infrastructure design life.

4. Is it possible to make use of future climate data?

Firstly a note on its availability: Future climate data is readily available from Environment and Climate Change Canada and from climate data providers such as Pacific Climate Impacts Consortium, Ouranos, and the Prairie Climate Centre. There are also consulting firms that develop their own Intensity-Duration-Frequency curves, and provide detailed hydrologic assessments, and for profit climate data providers such as Climate Change Hazards Information Portal who provide data, analysis and projections to aid decision making. The Canadian Climate Information Portal is the official source of reliable climate information, data, and tools from the Government of Canada. There is also the Canada in a Changing Climate report released this year[6] to identify the impacts of these changes on our communities, environment and economy, and how we are adapting.

While there is considerable uncertainty with respect to future greenhouse gas concentrations, the best available science suggests that uptake of detailed regional climatological studies could identify sector-specific vulnerabilities and guide micro-level design interventions required to build the resilience of infrastructure assets[7]. In terms of disaster management, data indicate that expenditures on disaster response are always higher than those directed at prevention measures such as resilience-building. For every US$7 spent on relief, US$1 is spent on risk reduction[8]. It

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[5] 2019 *Twenty Four Seven,* Demystifying Climate Scenario Analysis for Financial Stakeholders http://427mt.com/wp-content/uploads/2019/12/Demystifying-Scenario-Analysis_427_2019.pdf

[6] 2019 *Natural Resources Canada,* Canada in a Changing Climate Report

[7] 2013 Turnquist, Mark, and Eric Vugrin, *Environment Systems & Decisions,* Design for Resilience in

[8] 2013 Kellett, Jan, Alice Caravani, and Florence Pichon, *Overseas Development Institute and Global*

has also been shown that investing in hazard mitigation measures to exceed select requirements of the *2015 International Codes* (I-Codes), can save the proponents US$4 for every US$1 spent[9]. The answer to "by how much should we exceed requirements of Codes?" is provided by the establishment of the risk tolerance, which in turn is informed by the assessment of future climate data. While there are epistemic and model uncertainties related to use of the future climate data, its use can certainly help inform adaptation decisions and offer opportunities to design the future we pass on to subsequent generations. Understanding the scientific confidence in these future projections will lead to better use of the future projected climate data. For example, there is good confidence in how the mean temperatures will change, medium confidence in the precipitation trends, and limited confidence in projections on how the driving wind pressures will change. These differences in uncertainty should influence professionals to use these predictions differently depending on the context.

Recommendation: Use the dataset most appropriate for a specific Project context, and consider the uncertainties that are inherent in future predictions.

5. **Is there such a thing called maladaptation?**

In our efforts to prepare for the impacts of climate change, it is important to understand what maladaptation is. If the adaptation solutions increase the emissions of greenhouse gases, they may address current needs, they create a positive feedback by increasing emissions of greenhouse gases, thereby increasing the likelihood that further adaptation to climate change will be required in the future[10]. Adaptation actions are maladaptive if, in meeting the needs of one sector or group, they increase the vulnerability of those most at risk, such as minority groups or low-income households. Approaches may be maladaptive if their economic, social or environmental costs are high relative to alternatives. Actions are maladaptive if "they reduce incentive to adapt, for example by encouraging unnecessary dependence on others, stimulating rent-seeking behaviour, or penalizing early actors"[11]. If adaptation choices (here, infrastructural) restrict the range of future options, they create path dependency, reduce flexibility and reduce the room for manoeuvre of the system in the future.

Recommendation: A number of different decision-making frameworks are being increasingly used to asses if and when proactive adaptation measure to reduce climate risks are to be implemented. Examples of these are multi-criteria/multi actor analysis, cost benefit analysis and cost effectiveness analysis. Using such a framework allows analysis and prioritization based on non-monetary and monetary criteria. Such frameworks can be useful in supporting decision making around adaptation measure.

6. **What tools are available to manage risk?**

With respect to reducing emissions, enhancing resiliency and preparing for disasters, risk management decisions have a key role to play in preparing for and responding to climate change. While there are international codes and standards that deal with organization level quantification, reporting and verification of greenhouse gas emissions and removals (ISO 14064), adaptation to climate change (e.g., ISO 14090 and others being developed), and risk management (ISO 31000), risk management frameworks selected should aspire to reach beyond code levels of safety and performance to improve adaptive capacity of projects to "systems level risks", which transcend beyond just those that relate to the future climate (example risk categories include organizational, financial and operational). Strategic assessments of these systems level risks can help inform making better decisions amid deep uncertainty with respect to future climate.

Recommendation: Demand side legislation relating to infrastructure projects must consider a risk-based approach as opposed to a hazard-based approach as they don't include the consequence of failure. To effectively manage risk, Governments must establish the levels of acceptable risk with respect to natural hazards such as landslides, avalanches etc.

Facility for Disaster Reduction and Recovery, Financing Disaster Risk Reduction

9 2019 *National Institute of Building Sciences,* Natural Hazard Mitigation Saves: 2018 Interim Report.

10 2014 Alexander Magnan, *Sapiens*, Avoiding maladaptation to climate change: towards guiding principles

11 2010 Jon Barnett and Saffron O'Neill, *Global Environmental Change*, Pathways of maladaptation