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Critical Infrastructure Resilience team
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Dear Critical Infrastructure Resilience team

RE: CRITICAL INFRASTRUCTURE PHASE 1 CONSULTATION

GNS Science, Te Pū Ao (GNS Science) welcomes the opportunity to provide feedback on the discussion document: *Strengthening the resilience of Aotearoa New Zealand's critical infrastructure*. We have submitted answers to specific questions through the DPMC consultation portal.

GNS Science is a New Zealand Crown Research Institute and leading provider of Earth, geoscience and isotope research and consultancy services. Through our work we strive to enhance Aotearoa New Zealand's resilience to geological hazards, ensure sustainable management of the environment and effective adaptation to a changing climate; enable Aotearoa New Zealand to transition to a low-carbon future, support future energy ambitions; and provide a deeper understanding of our continent Te Riu-a-Māui/Zealandia. We are leaders in natural hazard, climate, environmental, energy and groundwater research, with a focus on disaster risk reduction, climate adaptation options, past and future environmental change, sustainable management of geothermal and groundwater resources, and emissions management. The research, monitoring and commercial services that GNS Science undertake are directly relevant to the delivery of a resilient critical infrastructure system and identifying shortcomings that need to be addressed to strengthen resilience.

GNS Science supports the three steps recommended by Te Waihanga (the Infrastructure Commission) to enhance the resilience of our critical infrastructure system; namely developing:

1. *A common definition of what counts as critical infrastructure and a framework for identifying which infrastructures are most critical;*
2. *A shared understanding among critical infrastructure entities and the government of hazards and threats affecting infrastructure systems; and*
3. *A coordinated approach to managing risks across the infrastructure system which accounts for the growing dependencies and interdependencies within and between infrastructures.*

Summary of Feedback

- We consider the first megatrend – climate change – should also explicitly include natural hazards.
- Government has an important role to play in enabling greater information sharing through appropriate investment and through regulating the provision of critical

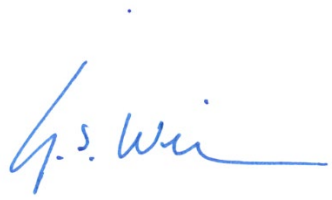
infrastructure data by owners and operators to enable the development and application of research, science and technology-based solutions.

- The Government should bring together the stakeholders from all infrastructure sectors to assess and monitor interdependencies.
- RiskScape (an open-source risk engine co-owned by GNS Science and NIWA and developed in partnership with Toka Tu Ake EQC) and MERIT (socio-economic and disruption modelling tool) have tremendous potential to transform our understanding of the risks and potential impacts of natural hazard and extreme weather events on New Zealand's critical infrastructure system.

We believe we provide critical infrastructure through our hazard monitoring, science advice, and risk modelling capabilities, but note that we have continued to struggle to provide it because there is no funding mechanism to resource it as critical infrastructure. Substantial additional resourcing would be needed to meet the requirements of officially designated Critical Infrastructure.

Thank you for the opportunity to provide feedback on strengthening the resilience of Aotearoa New Zealand's critical infrastructure system.

Yours sincerely



Gary Wilson
General Manager Research Strategy & Partnerships and
Chief Scientist

RESPONSE TO QUESTIONS SUBMITTED TO PORTAL

Section heading: **Background and context**:

- ***Are there additional megatrends that are also important that we haven't mentioned? If so, please provide details.***

We agree with the new megatrends identified, however, the first megatrend – **climate change** – should more explicitly include natural hazards. Although there is no clear evidence that damaging earthquakes, volcanic eruptions, tsunami, and earthquake-induced landslides are increasing in frequency or intensity, they continue to present major sources of risk to critical infrastructure, and in themselves justify the planned reforms. Moreover, the close links between climate change, rainfall-induced landslides and the damaging effects of coastal inundation dictate that any strategy to strengthen infrastructure resilience must consider the potential impacts and interdependencies of both climate change and natural hazards.

Under the fourth identified megatrend – **advent and rapid take up on new technologies** – it should be noted that new technologies, such as satellite and airborne remote sensing techniques, are playing an increasingly important role in providing rapid, high-resolution data sets for understanding natural hazards and climate change at national to local scales; rapid assessment of impacts following destructive events; and calibrating and validating hazard impact forecasts. Ensuring ongoing acquisition and sharing of such data sets and derived information should be included in any strategic response for delivering a more resilient critical infrastructure system.

Section heading: **Barrier one – A shared understanding**:

- ***How important do you think it is for the resilience of New Zealand's infrastructure system to have a greater shared understanding of hazards and threats?***

We consider it essential that there is a greater shared understanding of hazards and threats between the Government and critical infrastructure owners and operators. As the discussion paper sets out, there are numerous interdependencies between critical infrastructure networks (e.g., electricity, telecommunications, water and roads) *"…generate a risk of cascading service outages across the economy"*.

There are complex infrastructure ownership and governance relationships spanning both the private and public sectors, with only the Government having ultimate responsibility and oversight of the entire infrastructure system. For these reasons, we consider it essential that the Government take a leadership position and collaborates with network owners and operators to increase the sharing of hazard, threat and infrastructure information to increase the resilience of the critical infrastructure system.

New Zealand's energy supply system is a good example of a critical infrastructure network that would benefit from greater Government oversight and improved planning to improve its overall resilience to natural hazards and extreme weather events. The energy system is currently undergoing its largest transformation in more than 50 years, with many new renewable electricity generation plants, batteries and distribution networks commissioned, planned or

under investigation in many areas around the country that have different risk profiles for natural hazards and extreme weather events.

GNS Science observes that the investment decisions appear to be largely organic, driven primarily by the individual companies, with no clear oversight of how the new infrastructure is impacting the overall resilience of the broader energy supply network to natural hazard and extreme weather events. There is clearly a case for greater Government oversight to improve the network's resilience, including through the provision of appropriate funding.

- ***What do you think the government should do to enable greater information sharing with, and between, critical infrastructure owners and operators?***

The Government has an important role to play in enabling greater information sharing through appropriate investment and through regulating the provision of critical infrastructure data by owners and operators to enable the development and application of research, science and technology based solutions.

Currently, the assessment of hazard and risk posed to infrastructure in Aotearoa New Zealand is undertaken in an ad hoc and fragmented manner. A key issue is that there is no consistent national scale approach to assessing hazard and risk across perils, sectors, and geographic regions. Risk assessments may be undertaken at varying scales, with differing underpinning datasets and methodologies driven by the specific needs of a project. Thus, there are currently no assessments that allow for a direct "apples to apples" comparison across perils, sectors, and geographic regions.

However, this can be done, and work is underway to facilitate this. RiskScape, an open-source risk engine co-owned by GNS Science and NIWA and developed in partnership with Toka Tu Ake EQC, can enable a common risk calculation process and framework. Similarly, socio-economic and disruption modelling tool MERIT can help with end-to-end evaluation of infrastructure resilience options and defining the socially optimal level of resilience. To take advantage of these tools, it will be necessary for common and consistent hazard, asset, and vulnerability data to be available. A barrier to being able to produce these datasets is that there is currently no sustainable funding model to ensure that these can be produced and regularly updated. It is likely that this issue will require addressing to facilitate shared understanding across the sector relating to infrastructure resilience.

Section heading: **Barrier three - Managing significant national security risks**:

- ***Do you think there is a need for a government agency or agencies to have clear responsibility for the resilience of New Zealand's critical infrastructure system?***

To enable the continued development and application of tools such as GeoNet and RiskScape for improved infrastructure resilience, we recommend that the government (1) continue to invest in these tools, in partnership with critical infrastructure owners and other key stakeholders (e.g., Toka Tū Ake EQC), and (2) following the example of Australia's Security of Critical Infrastructure Act, introduce new regulatory measures requiring critical infrastructure owners and operators to lodge key data for all critical assets with government (e.g., asset type, location, capacity, failures, etc). These data could then be used by GNS Science and NIWA scientists to develop geospatially referenced infrastructure data layers for the energy,

telecommunications, water and road networks for inclusion in a shared multi-hazard RiskScape model for the entire critical infrastructure system. This model would provide a significant step change in understanding of the risks and potential impacts facing existing critical infrastructure and would guide the location and design of future infrastructure for a more resilient critical infrastructure system.

New technologies, such as satellite and airborne remote sensing techniques, are playing an increasingly important role in providing rapid, high-resolution data sets for understanding natural hazards and climate change at national to local scales; rapid assessment of impacts following destructive events; and calibrating and validating hazard impact forecasts. Ensuring ongoing acquisition and sharing of such data sets and derived information should therefore be included in any strategic response for delivering a more resilient critical infrastructure system.

This could be managed by a single agency or multiple agencies, but clear lines of responsibility are required.

Section heading: **Additional information**:

RiskScape and MERIT have tremendous potential to transform our understanding of the risks and potential impacts of natural hazard and extreme weather events on Aotearoa New Zealand's critical infrastructure system. It could be applied by infrastructure owners and government to undertake scenario-based planning to ensure that new infrastructure is optimally designed and located for network resilience with respect to the modelled hazard and climate-related risk.

The nature of interdependencies among the infrastructure systems makes it complex to understand the cascading failures of systems that could result in unacceptably long duration of disruptions to services. The Infrastructure Recovery Decision Support tool, which works along with RiskScape, models the duration and spread of service outage to quantify economic impact by MERIT. Currently, information on physical and operational interdependencies is lacking, which hinders the identification of critical assets in the infrastructure system. We recommend the Government brings the stakeholders from all infrastructure sectors together to assess and monitor interdependencies and requires this information to be widely available. The application of this analysis would assist with the setting of minimum standards for resilience by testing different criteria/measures.

GNS Science monitors earthquakes, tsunami, volcanoes and landslides via the GeoNet programme through a partnership with Toka Tū Ake EQC, the Ministry of Business, Innovation and Employment (MBIE), the National Emergency Management Agency (NEMA) and Land Information New Zealand (LINZ). The programme is Aotearoa New Zealand's geological hazard monitoring system that acquires and openly shares real-time data on earthquakes, tsunami, volcanoes and landslides. Data underpins all that GeoNet does and is the thread that sees GeoNet contribute across the '4 Rs'. The GeoNet infrastructure and data underlie 24/7 expert science advice in event response, and in recovery and reduction activities such as the new national seismic hazard model, which are used by infrastructure operators and other major stakeholders to understand and quantify exposure to natural hazards.